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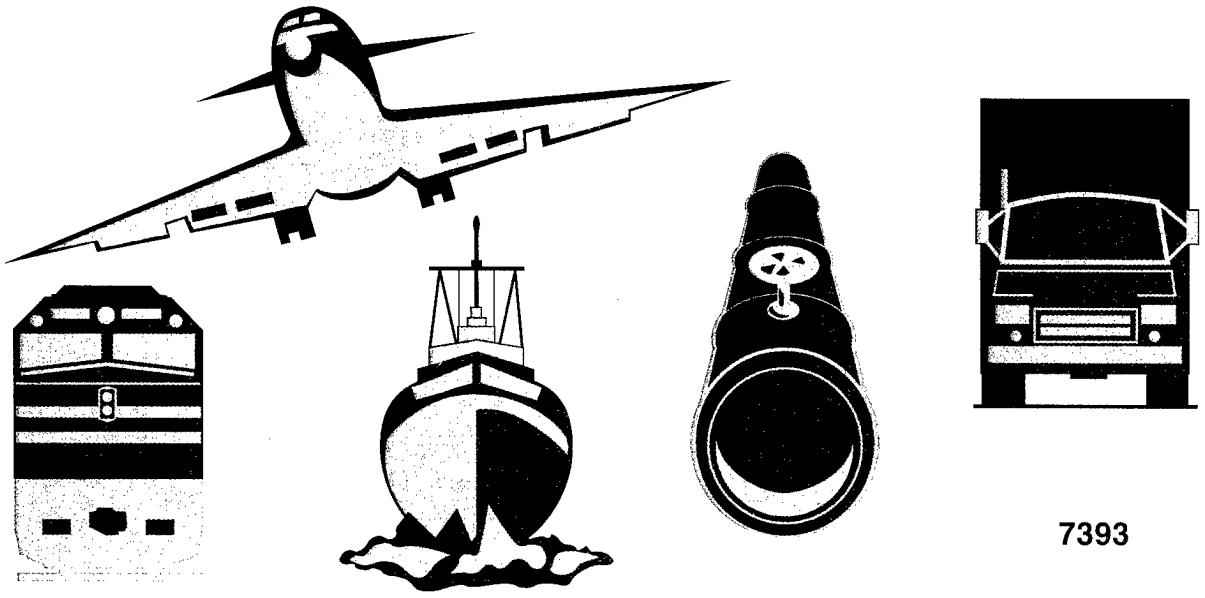
NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY STUDY

Public Aircraft Safety



7393

Safety Study

Public Aircraft Safety

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Abstract: "Public aircraft" are aircraft operated for the purpose of fulfilling a government function that meet certain conditions specified under Title 49 *United States Code*, Section 40102(a)(37). The Safety Board identified 341 public aircraft accidents that occurred during the years 1993–2000. Using activity data from the Federal Aviation Administration (FAA) (for the period 1996–1999), the Board calculated an accident rate of 3.66 accidents per 100,000 flight hours for nonmilitary, nonintelligence public aircraft. Using activity data from the General Services Administration (also for the period 1996–1999), the Board calculated an accident rate of 4.58 per 100,000 flight hours for nonmilitary, nonintelligence Federal aircraft. Both rates were lower than the general aviation accident rate (7.2 accidents per 100,000 flight hours), but higher than the accident rate for air taxis (3.47), scheduled Part 14 CFR 135 operations (1.06), or 14 CFR Part 121 operations (0.30). Comparisons between public and general aviation accidents revealed similar proportions of broad causal factors. However, accidents in these two sectors differed in other ways. A higher proportion of public aircraft crashed during local flights, at off-airport locations, and during maneuvering phases of flight. Also, accident-involved public aircraft pilots were more likely than accident-involved general aviation pilots to hold advanced ratings. Limitations and flaws associated with the FAA's nonairline activity estimates made it impossible for the Board to make carefully controlled comparisons of the safety of public versus civil aircraft. The data were not sufficiently detailed to support the calculation of public and civil aircraft accident rates for specific purposes of flight (for example, aerial observation, aerial application, and so on). Furthermore, FAA flight hour estimates are potentially biased because they are based on a survey that is administered to a sample of aircraft owners listed in the FAA's Civil Aircraft Registry, which is known to contain many outdated or inaccurate records. As a result of these findings, the Board made safety recommendations to the Federal Aviation Administration and the General Services Administration.

Contents

Acronyms and Abbreviations

Abbreviated Terms

Air-21	Wendell H. Ford Aviation Investment and Reform Act for the 21st Century
CAP	Civil Air Patrol
CFR	*Code of Federal Regulations*
FAA	Federal Aviation Administration
FAIRS	Federal Aviation Interactive Reporting System
FAMIS	Federal Aviation Management Information System
GA	general aviation
GADIT	General Aviation Data Improvement Team
GA survey	General Aviation and Air Taxi Activity Survey
GSA	General Services Administration
ICAP	Interagency Committee for Aviation Policy
OMB	Office of Management and Budget
PCIE	President's Council on Integrity and Efficiency
USPS	United States Postal Service
VIS	Vital Information Statistics

Executive Summary

Section 702 of Public Law 106–181, the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century, directed the National Transportation Safety Board to "conduct a study to compare the safety of public aircraft and civil aircraft," and to review safety statistics on aircraft operations since 1993. "Public aircraft" refers to certain government aircraft operations. Public aircraft status means, among other things, that an aircraft will not be subject to some of the regulatory requirements applicable to "civil" (or civilian) aircraft. Although the precise statutory definition has changed over the years, public aircraft operations generally include law enforcement, low-level observation, aerial application, firefighting, search and rescue, biological or geological resource management, and aeronautical research.

For this study, the Safety Board identified 341 public aircraft accidents that occurred during the years 1993–2000. Using activity data from the Federal Aviation Administration (FAA) (for the period 1996–1999), the Board calculated an accident rate of 3.66 accidents per 100,000 flight hours for nonmilitary, nonintelligence public aircraft. Using activity data from the General Services Administration (also for the period 1996–1999), the Board calculated an accident rate of 4.58 per 100,000 flight hours for nonmilitary, nonintelligence Federal aircraft. Both rates were lower than the general aviation accident rate (7.2 accidents per 100,000 flight hours), but higher than the accident rate for air taxis (3.47), scheduled 14 CFR Part 135 operations (1.06), or 14 CFR Part 121 operations (0.30). Comparisons between public and general aviation accidents revealed similar proportions of broad causal factors. However, accidents in these two sectors differed in other ways. A higher proportion of public aircraft crashed during local flights, at off-airport locations, and during maneuvering phases of flight. Also, accident-involved public aircraft pilots were more likely than accident-involved general aviation pilots to hold advanced ratings.

Limitations and flaws associated with the FAA's nonairline activity estimates made it impossible for the Safety Board to make carefully controlled comparisons of the safety of public versus civil aircraft. The data were not sufficiently detailed to support the calculation of public and civil aircraft accident rates for specific purposes of flight (for example, aerial observation, aerial application, and so on). Furthermore, FAA flight hour estimates are potentially biased because they are based on a survey that is administered to a sample of aircraft owners listed in the FAA's Civil Aircraft Registry, which is known to contain many outdated or inaccurate records.

As a result of this study , the Safety Board issued eight safety recommendations to the Federal Aviation Administration and two safety recommendations to the General Services Administration.

Chapter 1

Background

Section 702 of Public Law 106–181, the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Air-21), directed the National Transportation Safety Board to "conduct a study to compare the safety of public aircraft and civil aircraft," and to review safety statistics on aircraft operations since 1993. "Public aircraft" refers to certain government aircraft operations. Public aircraft status means, among other things, that an aircraft will not be subject to some of the regulatory requirements applicable to "civil" (or civilian) aircraft. (Appendix A provides a partial listing.)[1] Although the precise statutory definition has changed over the years, public aircraft operations generally include law enforcement, low-level observation, aerial application, firefighting, search and rescue, biological or geological resource management, and aeronautical research.[2]

The Independent Safety Board Act Amendments of 1994 narrowed the definition of public aircraft, expanding the number of nonpublic government aircraft operations (considered "civil" by the Federal Aviation Administration (FAA)). The act specified that, among other things, public aircraft status did not attach to government-owned aircraft transporting passengers (other than those persons required to be on board the aircraft to accomplish the government function for which the aircraft is operated, such as search and rescue or in-flight research), unless the aircraft was operated by the Armed Forces or a United States intelligence agency.[3] Air-21 further redrafted the definition of public aircraft, modifying the statutory language to more clearly specify requirements for public aircraft status.

[1] Although all aircraft must follow certain sections of 14 CFR Part 91, public aircraft operators do not have to comply with safety regulations, including maintenance rules under 14 CFR Part 43 or pilot certification standards under 14 CFR Part 61.

[2] Aircraft used by the Department of Defense are also public aircraft, but this study considered only nonmilitary, nonintelligence aircraft.

[3] P.L. 103–411. The 1994 amendments also bestowed upon NTSB, for the first time, specific jurisdiction to investigate all accidents involving public aircraft, except those public aircraft operated by the Armed Forces or by a United States intelligence agency. Prior to the 1994 amendments, however, the NTSB had in place memoranda of understanding with many government operators that enabled NTSB investigation of a number of public aircraft accidents.

The term "public aircraft" is actually somewhat misleading because the phrase refers not to a specific population of aircraft, but to government-sponsored flights meeting specific criteria laid out in the *Code of Federal Regulations* (CFR). Essentially, public aircraft operations are a subset of government-sponsored aircraft operations (figure 1).

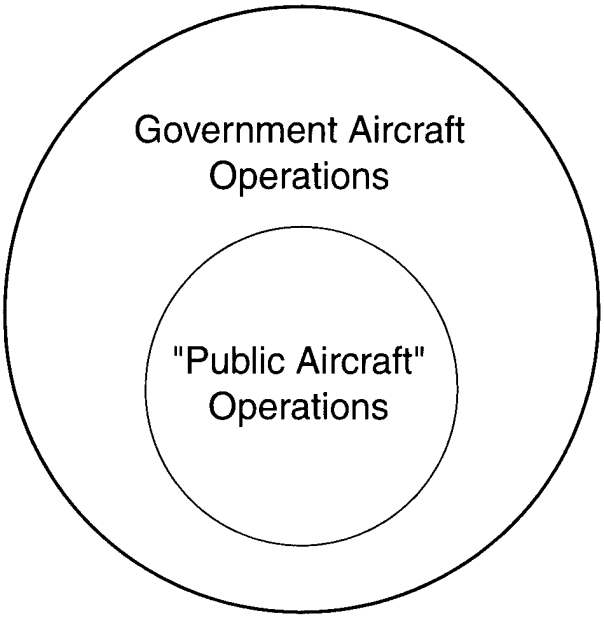

Figure 1. Government aircraft operations versus "public aircraft" operations.

The regulations determining whether a particular flight qualifies for public aircraft status are complicated. Appendix B presents the current statutory definition of "public aircraft." In this report, the term "public aircraft operations" will be used to describe flight operations meeting the statutory definition of public aircraft detailed in appendix B. "Public aircraft" will describe aircraft performing these operations. "Government aircraft operations" will describe the larger set of flight operations conducted to perform a government function (of which public aircraft operations are a part).

Oversight of Public Aircraft Operations

Because public aircraft operators are exempted from certain aviation safety regulations, government organizations conducting public aircraft operations supervise their own flight operations without oversight from the FAA. Oversight policies are most clearly specified at the Federal level. A circular issued by the U.S. Office of Management and Budget (OMB) has guided aircraft management at executive agencies of the Federal government since 1983.[4] A 1989 revision of the circular directed the U.S. General

[4] OMB Circular A-126 "Improving the Management and Use of Government Aircraft."

Services Administration (GSA) to create and maintain a single office responsible for oversight of Federal aircraft management and to establish a single interagency committee for assisting the GSA in this role. This led to the creation of the Interagency Committee for Aviation Policy (ICAP).[5] A 1992 revision of the circular specified, among other things, requirements for aviation safety programs within Federal agencies, adding the responsibility for collecting accident and incident data. In addition, the revision recommended that Federal agencies adhere voluntarily to portions of the *Federal Aviation Regulations* from which they were exempted.

The United States Senate Committee on Governmental Affairs, Subcommittee on General Services, Federalism, and the District of Columbia, chaired by Senator Jim Sasser (D–TN), began a study of the Federal government's management of its civilian aircraft fleet in August 1991. In its report, *Management of Federal Civilian Aircraft: Findings and Recommendations*, presented to President William J. Clinton in April 1993, the subcommittee reported that information concerning inventory and usage of aircraft was inaccurate or incomplete, that many aircraft were underutilized, and that there were no binding safety standards in effect. In addition, the subcommittee concluded that the GSA had been hampered in dealing with other executive agencies by a perception that the GSA lacked adequate authority and aviation-related expertise. In response to these findings, the subcommittee proposed a blueprint for reforming the management of government aircraft. Executive agencies responsible for government aircraft operations were directed to cooperate with an audit conducted by the GSA inspector general. In addition, the subcommittee recommended that Congress consider eliminating "the exemption of Federal civilian aircraft from commercial aviation safety requirements, providing for specific exemptions only after the demonstration of unusual or extraordinary government needs."[6]

Three well-publicized public aircraft accidents in a 14-month period in 1992 and 1993 also brought scrutiny on government aircraft operations, and public aircraft operations in particular. On August 7, 1992, a State-owned Sikorski S-76A helicopter crash-landed near Graefenburg, Kentucky, seriously injuring five of the six persons aboard, including the Governor of Kentucky.[7] The Safety Board reported that the probable cause of this accident was an inadequate preflight inspection by the flight crew who failed to ensure that all four of the engine cowling latches were properly secured, which resulted in subsequent failure of section II of the tail rotor drive shaft after the cowling contacted the main rotor blades and tail rotor drive shaft.

On April 19, 1993, a State-owned Mitsubishi MU-2B-60 crashed near Zwingle, Iowa, following the in-flight loss of a propeller blade at 24,000 feet, killing South Dakota

[5] The GSA established the ICAP in 1989 at the direction of the OMB. The GSA chairs the committee. About 17 Federal agencies are members, although this number varies from year to year. With advice from ICAP, GSA makes policy for Federal aviation management.

[6] United States Senate Committee on Governmental Affairs, Subcommittee on General Services, Federalism, and the District of Columbia [Jim Sasser, Chairman], *Management of Federal Civilian Aircraft: Findings and Recommendations* (Washington, DC: U.S. Senate, April 2, 1993).

[7] NTSB Accident No. NYC92GA147.

Governor George Mickelson and eight others.[8] The Safety Board reported that the probable cause of this accident was fatigue cracking and fracture of the propeller hub arm. The resulting separation of the hub arm and the propeller blade damaged the engine, nacelle, wing, and fuselage, thereby causing significant degradation of aircraft performance and control that made a successful landing problematic. The cause of the propeller hub arm fracture was a reduction in the fatigue strength of the material because of manufacturing and time-related factors, that reduced the fatigue resistance of the material, probably combined with exposure to higher-than-normal cyclic loads during operation of the propeller at a critical vibration frequency which was not appropriately considered during the airplane/propeller certification process.

On October 26, 1993, a Beechcraft 300-F owned and operated by the FAA crashed into a mountain near Front Royal, Virginia, while on an airport inspection trip, killing three persons.[9] In its accident report, the Safety Board faulted the FAA flying program for inadequate management oversight, stating that the probable cause of this accident encompassed not only the failure of the pilot-in-command to ensure that the airplane remained in visual meteorological conditions over mountainous terrain, but also the failure of the FAA executives and managers responsible for the FAA flying program to: (1) establish effective and accountable leadership and oversight of flying operations; (2) establish minimum mission and operational performance standards; (3) recognize and address performance-related problems among the organization's pilots; and (4) remove from flight operations duty pilots who were not performing to standards.

In December 1996, the President's Council on Integrity and Efficiency (PCIE) issued a report on the Federal civilian agencies' aircraft management programs.[10] A series of audit reports (20 reports covering 11 different agencies) prepared by the GSA inspector general were included in the PCIE report. These audits confirmed the safety-related, operational, and administrative shortcomings described in the Sasser report. The GSA found frequent and significant instances where agency safety standards (generally less stringent than FAA safety regulations) were not being met. The authors of the PCIE report lauded the provision of the Independent Safety Board Act Amendments of 1994 requiring government aircraft operations involving carriage of passengers or cargo to comply with FAA standards. The report also acknowledged the provision giving the Safety Board the responsibility and authority to investigate all nonmilitary, nonintelligence public aircraft accidents, commenting, "these actions go a long way towards addressing the concerns relating to aircraft safety."

In 1997, the Associate Administrator, Office of Governmentwide Policy, GSA, established an independent Aircraft Management Policy Advisory Board to examine all aspects of the management of federally sponsored aviation programs, including safety aspects. In June 1998, the advisory board reported that, although progress had been made

[8] NTSB Accident No. DCA93GA042.

[9] NTSB Accident No. DCA94GA010.

[10] President's Council on Integrity and Efficiency, *Combined Report on the Federal Civilian Agencies' Aircraft Management Programs*, Report No. A43006/O/W/F97011 (Washington, DC: PCIE, December 16, 1996).

on the issues raised in the Sasser and PCIE reports, fundamental problems remained, and these problems stemmed from a lack of independent safety oversight of Federal aircraft operations. In addition, the advisory board referred to "a continuing questioning of GSA's role in Federal public aircraft management," stating, "there is widespread uncertainty about who is in charge, and there is no clear enforcement authority." As a result of these findings, the advisory board recommended: (a) the revision of OMB Circular A-126 to better define GSA's authority to set aircraft management policy and safety guidelines, (b) the proposal of statutory language to Congress that would place the responsibility for regulation, oversight, and enforcement of all Federal government aircraft operations on the FAA, and (c) the allocation of resources to the FAA commensurate with this increase in responsibilities.[11] The advisory board also recommended that the GSA associate administrator be designated chair of the ICAP, and that ICAP member agencies appoint representatives of equivalent stature to ease GSA's dealings with the member agencies on matters involving aircraft management.

Since the release of the advisory board's recommendations, GSA has assisted the OMB in drafting a revision of Circular A-126. GSA also drafted a revision of its own regulations, to be contained in 41 CFR 102-33, to better define its authority for aircraft management. Both revisions are being reviewed by OMB and have yet to be formally approved. The GSA deputy associate administrator met with representatives of the FAA and congressional staff members in mid-1998 to discuss the advisory board's recommendation that GSA propose statutory language to Congress placing the responsibility for regulation, oversight, and enforcement of all Federal government aircraft operations on the FAA. According to a representative of the GSA's Aircraft Management Policy Division, neither the FAA nor congressional staff members present at that meeting were receptive to the recommendation. No further action has been taken. In other developments, the GSA has designated its associate administrator as the chair of ICAP, and some of ICAP's member agencies have appointed representatives of equivalent stature to ease GSA's dealings with those agencies.

FAA Analysis of Public Aircraft Safety

The FAA performed an analysis of public aircraft safety in 1997.[12] This study, which explored the legislative history and the characteristics of government-owned or government-operated aircraft and examined available safety data, was never published. It was, however, used as the basis for a briefing of the U.S. General Accounting Office, which was examining the issue of public aircraft safety in response to the conclusions and recommendations published in the report of the GSA's Aircraft Management Policy Advisory Board. The number of aircraft engaged in government aircraft operations was estimated in the FAA study using preliminary data from the ICAP, which had begun to

[11] U.S. General Services Administration, *Report of the Aircraft Management Policy Advisory Board* (Washington, DC: GSA, 1998).

[12] Federal Aviation Administration Office of Accident Investigation, Safety Analysis Branch, "An Analysis of Public Aircraft Safety" (Washington, DC: FAA, 1997, unpublished document).

build a list of aircraft owned or operated at all levels of government,[13] and data from the FAA's National Vital Information Statistics (VIS) database.[14] The FAA compared accident characteristics for government versus general aviation (GA) operations, and across levels of government. The resulting FAA analyses were of limited value because the FAA lacked activity statistics for government aircraft operations.

Since that time, the FAA has begun publishing public aircraft flight hour estimates. The FAA first released estimates in 1997 for the 1996 calendar year. In its study, the Safety Board used these data to compare the safety of public and civil aircraft operations.[15] The Board calculated accident rates for the period 1996–1999 rather than 1993–present because FAA estimates of public aircraft activity were available only for these years. Furthermore, the Board was not responsible for investigating most public aircraft accidents prior to mid-1995. Before 1996, the Board's public aircraft accident record is less complete. In short, the period 1996–1999 was the time frame for which complete data were available. The remainder of the report discusses the calculation of these rates, comparison of accident characteristics, and data limitations encountered by Safety Board staff during the course of this effort to compare the safety of public and civil aircraft.

[13] This data collection effort, performed primarily by the Department of Energy, an ICAP member, has since been discontinued because of difficulties in maintaining the currency of the data set.

[14] The FAA uses the VIS database to track commercial and government certificates.

[15] Accident rates are calculated by dividing accidents by some measure of transportation activity, such as trips taken, miles traveled, or hours spent in transit. This adjustment is sometimes called "normalization." The rationale for normalization is as follows: travelers and system operators run the risk of experiencing a transportation accident primarily when they travel. The more people travel, the more they are exposed to risk, and the more likely they are to be involved in a transportation accident.

Chapter 2

Accident and Exposure Data

Accident Data

The Safety Board maintains the official government census of civil aviation accidents and, as of April 23, 1995, certain public aircraft accidents as well.[16] The Independent Safety Board Act Amendments of 1994 required most public aircraft operators to report accidents to the Safety Board. The Board relies on its investigators to identify incoming reports of public aircraft accidents, and to distinguish these from civil aircraft accidents. Investigators code accident-involved public aircraft "public use" or "investigation of a government agency" as they enter accident data in the Board's Aviation Accident/Incident Database. Based on these codings, Safety Board staff identified over 300 accidents that occurred between January 1993 and December 2000.

Staff reviewed a brief report of each accident in the sample. The case-by-case review of the public aircraft accident sample could not ensure that every accident flight was operated in a manner consistent with the statutory definition of public aircraft in effect at the time the accident occurred. The statutory definition of public aircraft status takes many factors into account that are not documented in a typical aircraft accident record (for example, length of the lease agreement for State governments, presence of nonessential crewmembers, and so on). The purpose of the review was merely to look for cases where the information in the accident record was clearly inconsistent with classification of an aircraft operation as public.

Staff inspected each case to determine whether the owner or the operator of the accident aircraft was a nonmilitary, nondefense government organization. If so, the case was retained. If not, the long narrative and the accident docket for that accident were examined for other information suggesting that the aircraft was on a government-sponsored mission. If such evidence was found, the case was retained. If no such information was found, the case was discarded. Eleven accidents (3 percent of the accident set) were eliminated from the sample based on these criteria. Three additional accidents were discarded during the review process because they involved aircraft operated by non-U.S. governments that crashed outside U.S. territory.[17] Although they were on a mission sponsored by a military organization, two privately owned aircraft operating under contract to the U.S. Coast Guard and seven privately owned aircraft operating under contract to the Department of Defense were included in the accident sample because the operators were civilian. These aircraft are excluded from the accident sample used for calculating the Federal aircraft accident rate later in this report.

[16] The Safety Board does not maintain official records of military or intelligence aircraft accidents.

[17] NTSB Accident Nos. FTW97RA314, IAD00RA033, and SEA00WA163.

During the review, staff noticed one systematic error made by the Safety Board's investigators: Civil Air Patrol (CAP) accidents were coded public use, despite the fact that CAP flights are not technically considered public aircraft. CAP aircraft were left in the accident sample because the FAA includes CAP flight hours in its estimate of public use flight activity. (Appendix C gives a more detailed explanation.)

The final sample consisted of 343 public aircraft involved in 341 accident events (table 1). These accidents resulted in 167 deaths and 220 injuries. Each record contained information on a variety of event-, aircraft-, and occupant-related variables. Staff classified the accidents in terms of severity using a four-category classification system developed by the Board for classifying air carrier accidents (table 2).[18] Staff also classified accident-involved public aircraft according to the level of government served (table 3). The majority of the missions (51 percent) were Federal. The rest were divided evenly between State and local governments. Five pre-1996 accident aircraft could not be categorized by level of government because their accident records lacked sufficient detail.[19]

[18] This classification system was developed by the Safety Board in response to congressional direction under the Federal Aviation Reauthorization Act of 1996 to develop a system that was more informative than the traditional fatal/nonfatal dichotomy.

[19] NTSB Accident Nos. ATL93T#A01, MIA93T#A02, FTW94T#A03, SEA94T#A05, and ANC95T#A01.

Table 1. Accident-involved public aircraft and associated injuries, 1993–2000.[a]

Type of operation	Year	Accident aircraft	Accident severity		Injuries		
			Fatal	Nonfatal	Persons killed	Persons injured	Persons uninjured
Public Aircraft	1993	36	8	28	23	25	50
	1994	46	10	36	24	48	42
	1995	45	9	36	19	18	49
	1996	42	6	36	12	20	42
	1997	41	9	32	15	34	43
	1998	46	15	31	25	23	46
	1999	41	6	35	22	31	54
	2000	46	15	31	27	21	36
	Total	**343**	**78**	**265**	**167**	**220**	**362**
General Aviation[b]	1993	2,059	405	1,654	740	1,020	2,227
	1994	2,014	410	1,604	730	1,052	2,188
	1995	2,077	420	1,657	734	964	2,242
	1996	1,939	368	1,571	634	898	1,944
	1997	1,873	362	1,511	641	914	1,928
	1998	1,930	377	1,553	628	892	1,937
	1999	1,938	349	1,589	630	925	2,032
	2000	1,870	356	1,514	630	844	1,990
	Total	**15,700**	**3,047**	**12,653**	**5,367**	**7,509**	**16,488**
Air Taxi	1993	87	23	64	42	24	41
	1994	96	29	67	63	32	36
	1995	88	26	62	52	14	23
	1996	102	30	72	63	22	23
	1997	100	20	80	39	23	31
	1998	86	17	69	45	10	40
	1999	87	17	70	38	14	31
	2000	92	23	69	71	10	43
	Total	**738**	**185**	**553**	**413**	**417**	**1,296**

[a] Statistics for general aviation and air taxi operations are provided as context for the public aircraft accident statistics. Accident-involved public, general aviation, and air taxi aircraft were identified by Safety Board staff using the Board's Aviation Accident/Incident Database.

[b] The Board's policy has been to include public aircraft accidents that are investigated by the Board in the category "general aviation" for press releases containing aviation safety statistics and for the Annual Review of Aircraft Accident Data. This practice was continued here to maintain consistency with aviation safety statistics previously published by the Board. As a result, 285 public accident aircraft and related injuries were included in the general aviation statistics presented in this table. Most of these accidents occurred during 1995 and later years.

Table 2. Classification of public, general aviation, and air taxi accidents by severity.[a]

Severity	Public		General aviation		Air taxi	
	Accidents	Percent	Accidents	Percent	Accidents	Percent
Major	109	32	4,247	27	205	33
Serious	29	9	1,148	7	39	6
Injury	1	0	126	1	6	1
Damage	202	59	9,957	64	379	60
Unknown			31	0	1	0
Total	**341**	**100**	**15,509**	**100**	**630**	**100**

[a] Statistics for general aviation and air taxi operations are provided as context for the public aircraft accident statistics. Accident-involved public, general aviation, and air taxi aircraft were identified by Safety Board staff using the Board's Aviation Accident/Incident Database. Multiple-aircraft accidents were counted as a single event for this table. Accident severity was defined as follows: *major accident*—an aircraft was destroyed, more than one person was killed, or an aircraft was substantially damaged and one person was killed; *serious accident*—no airplanes were substantially damaged but one person was killed, or an aircraft was substantially damaged and at least one person was seriously injured; *injury accident*—no airplane was substantially damaged but at least one person was seriously injured; *damage accident*—an aircraft was substantially damaged and no one was killed or seriously injured.

Table 3. Level of government served by accident-involved public aircraft, 1993–2000.[a]

Year of accident	Federal	State	Local	Unknown	Total
1993	18	7	9	2	36
1994	22	10	12	2	46
1995	22	11	11	1	45
1996	27	9	6		42
1997	19	12	10		41
1998	27	9	10		46
1999	14	13	14		41
2000	25	10	11		46
Total	**174**	**81**	**83**	**5**	**343**

[a] Accident-involved public, general aviation, and air taxi aircraft were identified by Safety Board staff using the Safety Board's Aviation Accident/Incident Database. Level of government mission was determined by examining the aircraft operator and the narrative information contained in Board accident records. Five accident aircraft (cases ATL93T#A01, MIA93T#A02, FTW94T#A03, SEA94T#A05, and ANC95T#A01) could not be categorized. All five of these aircraft crashed prior to 1996, and these accidents were not investigated by Safety Board personnel.

Exposure Data

The Safety Board gathered government aircraft flight hour data from two sources: the FAA Office of Aviation Policy and Plans, and the GSA Aircraft Management Policy Division. The FAA publishes activity estimates for "public use" aircraft operations, a category that is similar to but less restrictive than the statutory definition for public aircraft.[20] The GSA collects flight hour data from executive agencies of the Federal government that operate aircraft. The two sets of exposure data cover overlapping sets of operations, but they are collected independently. The FAA estimates activity for all levels

[20] The FAA defines "public use" aircraft operations on its flight hour survey questionnaire as "Federal, state, or local government owner or leased aircraft used for the purpose of fulfilling a governmental function."

of government; the GSA reports activity only for the Federal government.[21] Both sets of activity statistics describe populations of government aircraft operations that are broader than the population of operations qualifying for public aircraft status. However, they are the best data currently available.

The Safety Board could not find independent estimates of State or local public aircraft activity. The PCIE report in 1996 acknowledged the difficulty in finding such information, as did the FAA's unpublished analysis of public aircraft safety in 1997. During the search for data on State and local public aircraft operators, the Safety Board could not locate even a comprehensive list of State or local government aircraft operators. The National Association of State Aviation Officials provided a list of 165 aircraft involved in State executive transportation. Since the statutory change in 1994, however, executive travel has not been categorized as a public aircraft operation. The U.S. Department of Agriculture provided a list of State forestry contacts. However, this list of contacts included county agencies, local agencies, Federal employees, and private citizens, with no clear means to distinguish among the operators in terms of level of government. The Airborne Law Enforcement Association indicated that the organization did not maintain a comprehensive list of operators or operational data. After repeated efforts yielded no useful information, the Safety Board proceeded with the study using the best approximations of public aircraft activity available: flight hour estimates from the FAA and the GSA.

All Public Aircraft Operations

The FAA Office of Aviation Policy and Plans obtains its public use aircraft activity estimates from the FAA-sponsored General Aviation and Air Taxi Activity Survey (GA survey). The first GA survey took place in 1978,[22] collecting data on flight activity during the 1977 calendar year. Since 1978, the name of the survey has changed, but the FAA's overall approach to estimating nonairline flight activity has remained the same, with some minor changes in the design of the sampling process. Questionnaires for the 1999 survey were mailed to the registered owners of over 30,000 nonairline aircraft (about 12 percent of the fleet).[23] The FAA selected these aircraft from all aircraft records in the FAA's Civil Aviation Registry, using a stratification procedure based on 19 aircraft categories and 9 geographic regions. Combining these two dimensions yielded 172 different aircraft groups from which samples were drawn at random. In statistical terms, these groups are referred to as cells of the sample frame matrix. Within each cell, a predetermined number of aircraft were selected for inclusion in the survey. The number of

[21] These activities do not include military or intelligence aircraft operations.

[22] Prior to 1978, the FAA used the Aircraft Registration Eligibility, Identification, and Activity Report, AC Form 8050, to collect data on GA activity and avionics. The form was sent to all owners of civil aircraft in the United States and served two purposes: Part 1 was a mandatory aircraft registration revalidation form, and Part 2 was voluntary and applied to GA aircraft only, asking questions on the owner-discretionary characteristics of the aircraft such as flight hours, avionics equipment, base location, and use. This information was used by the FAA to estimate aircraft activity.

[23] The FAA surveys aircraft owners, not pilots, because the GA survey is also used to acquire information on aftermarket avionics equipage and because pilots commonly fly multiple aircraft.

aircraft selected were chosen to minimize sampling error and to ensure that individual aircraft owners were surveyed as infrequently as possible.

Each aircraft owner selected for inclusion in the 1999 survey received a standardized 19-question GA survey form. This form requested the following information: hours flown by the aircraft during the calendar year, lifetime airframe hours, percentage of flight hours that the aircraft operated while rented or leased, and proportion of flight hours under different flight plans and weather conditions. In addition, owners were asked to estimate the percentage of hours flown for each of 15 different purposes (table 4). "Public use" was included as a response category for 1996 and subsequent years. Beginning with the 1996 survey data, the FAA estimated public aircraft flight hours by multiplying an aircraft's total flight hours by the percentage of hours flown for "public use," weighting each product by an appropriate constant related to the sample design, and summing the results across aircraft.

Table 4. Purpose-of-flight categories for the 1999 GA survey.[a]

1. *Personal/Recreational:* Flying for personal reasons (excludes business transportation)
2. *Instructional:* Flying under the supervision of a flight instructor (includes student pilot solo; excludes proficiency flight)
3. *Business Transportation:* Individual use for business transportation without a paid, professional crew
4. *Corporate/Executive Transportation:* Business transportation with a paid, professional crew
5. *Regional/Commuter:* 14 CFR Part 135 scheduled passenger service only
6. *Air Taxi:* 14 CFR Part 135 on-demand passenger and all cargo operations (not scheduled passenger service or air tours)
7. *Air Tours:* Commercial sight-seeing conducted under 14 CFR Part 135
8. *Sightseeing:* Commercial sight-seeing conducted under 14 CFR Part 91
9. *Public Use:* Federal, state, or local government owner or leased aircraft used for the purpose of fulfilling a governmental function
10. *Aerial Observation:* Aerial mapping/photography, patrol, search and rescue, hunting, traffic advisory, ranching, surveillance, oil and mineral exploration, etc.
11. *Aerial Application in Agriculture and Forestry:* Crop and timber production and protection
12. *Other Aerial Application:* Public health sprayings, cloud seeding, firefighting, including forest fires, etc.
13. *External Load:* Operation under 14 CFR Part 133, rotorcraft external load operations, examples include; helicopter hoist, hauling logs, etc.
14. *Air Medical Services:* Air ambulance services, rescue, human organ transportation
15. *Other Work Use:* Construction work (not 14 CFR Part 135 operation), parachuting, aerial advertising, towing gliders, etc.

[a] These categories and associated definitions were provided on the 1999 General Aviation and Air Taxi Activity survey form.

While studying the FAA's public aircraft flight hour estimation process, the Safety Board identified important weaknesses that should be discussed in this report, because the comparison of public and civil aircraft safety contained in this report depended on the reliability and validity of flight hour estimates.

First, as mentioned earlier, the definition of "public use" provided on the GA survey form is broader than the statutory definition for public aircraft. The definition on

the survey form actually refers to all government aircraft operations. Therefore, the flight hour estimate is an inflated substitute for actual public aircraft flying activity.

Second, the estimation of aircraft flight hours by purpose of flight depends, to a great extent, on the record-keeping policies and memories of aircraft owners, and, in some cases, the willingness and ability of aircraft owners to obtain needed information from the pilots who fly their aircraft. When the owner is not the sole operator of an aircraft, the owner may have difficulty estimating flight hours by purpose of flight. It is difficult to know the extent to which these difficulties might distort flight hour estimates, but the potential for error clearly exists.

Third, the FAA's Civil Aviation Registry records are used to estimate the size and characteristics of the GA fleet and as a source of contact information for mailing surveys to aircraft owners. After surveys are returned, registry data are used to extrapolate reported activity to the entire GA fleet. The quality of the activity estimates derived from the GA survey depends greatly on the accuracy and completeness of records in the registry. However, the FAA contractor responsible for conducting the GA survey recently estimated that the proportion of incorrect GA aircraft records in the registry lies between 19 and 40 percent.[24]

In order to explain how this could be possible, it is important to understand the FAA's aircraft registration policies (as specified in 14 CFR Part 47). When someone purchases an aircraft they intend to operate, they must submit an application for registration to the Civil Aviation Registry. This application contains certain information about the aircraft as well as contact information for the aircraft owner. After initial registration, 14 CFR 47.45 requires the aircraft owner to notify the FAA aircraft registry within 30 days of any permanent change of address. After 3 years has elapsed since receipt of registration information from an aircraft owner, the FAA sends a Triennial Aircraft Registration Report form. The aircraft owner is required to return this form within 60 days, verifying basic aircraft information as well as contact information for the owner. Although 14 CFR 47.51 specifies that "Refusal or failure to submit the Triennial Aircraft Registration Report with the information required by this section may be cause for suspension or revocation of the Certificate of Aircraft Registration," the FAA has not enforced this requirement for at least 20 years. Neither has the FAA enforced the requirement to submit notification to the FAA within 30 days of a permanent change of address. (Appendix D provides selected portions of 14 CFR Part 47 describing aircraft registration requirements.)

Owner contact information and other parts of an aircraft record are outdated for many aircraft. Evidence also suggests that the currency of the registry continues to deteriorate. Each year, the contractor conducting the GA survey excludes aircraft owners

[24] Based on analyses by the FAA's principal contractor for the GA survey, PA Consulting, as described in a memo from Nicholas Nitka and Lark Lee to the FAA on April 6, 2001. Incorrect records were described as GA aircraft records that did not have correct address information and GA aircraft records in the registry that were not actually part of the active GA fleet, that is, air carriers, destroyed aircraft, museum aircraft, military-owned aircraft, and so on.

from consideration in the survey because the registry database indicates that their contact information is outdated. The contractor also excludes aircraft owners with postmaster returns on record from prior GA surveys they have conducted. After these known outdated records are excluded, a sizable percentage of GA surveys (10 percent in 1999) are returned by the U.S. Postal Service (USPS) with information indicating that the address is no longer valid and that the USPS has no forwarding address on file. The FAA contractor responsible for analyzing GA survey returns has estimated that the number of records in the Civil Aviation Registry that were valid for inclusion in future GA surveys (after known outdated records were excluded) decreased from 79 percent in 1999 to 74.8 percent in 2000.[25]

In a meeting with Safety Board staff, managers at the Civil Aviation Registry stated that a fairly constant proportion of owner addresses (currently about 10 percent) have at least two USPS returns on record in response to triennial registration form mailings.[26] Registry staff reported that they have taken steps to prevent further deterioration in the accuracy of aircraft records in recent years. On May 4, 1999, the registry began biannual comparisons between the FAA's database of registered aircraft owners and the USPS's database of change-of-address forms submitted by U.S. residents. In cases where a match has been made, the registered aircraft owner was sent a letter asking whether they wanted their contact information updated to reflect the new address. About 2,000 of the 20,000 letters sent to aircraft owners under this new program were mailed back. Some owners requested that the registry change their principal contact information, and some requested that their principal contact information remain the same. The reasons why the remaining 18,000 aircraft owners contacted in these mailings did not respond to the FAA are not documented.

Another way the FAA hopes to improve the currency of its Civil Aviation Registry is through online verification of aircraft registration information by aircraft owners. The FAA began offering aircraft owners the capability to query and inspect aircraft registration information online on April 4, 2001. It is now possible for aircraft owners to look up their own aircraft on the Internet and examine the accuracy of the aircraft record. The FAA provides a downloadable form that can be mailed to the registry for correction of any inaccuracies. Interest in the Web site appears to be high. According to registry managers, the site had over 300,000 "hits" within 2 months of its debut. The managers hope that this new capability will lead many aircraft owners to submit updated registration information, thereby improving the currency of the registry. They plan to run ads in industry magazines encouraging pilots to take advantage of this new method of verifying the accuracy of their aircraft registration information.

In an interview with Safety Board staff, registry managers stated that they were opposed to the imposition of civil penalties for violation of aircraft registration regulations. They felt it would damage the cooperative relationship they have attempted to

[25] Memo from Nicholas Nitka and Lark Lee, PA Consulting, to Arthur Salomon, Federal Aviation Administration, April 6, 2001.

[26] Meeting conducted with Mark Lash, Manager, Civil Aviation Registry, and Julie Stanford, Manager, Aircraft Registration Branch, Civil Aviation Registry, on May 30, 2001.

cultivate with aircraft owners. They cited an attempt in 1978 to enforce aircraft registration requirements which resulted in the deletion of 15,323 aircraft records from the registry before the effort was halted. According to registry personnel, many of these aircraft were never re-registered. The number of these aircraft that remained active is unknown. The only real result of this attempt at enforcement, the managers argued, was a reduction in the number of aircraft records contained in the registry.

Fourth, the GA survey produces imprecise public use flight hour estimates because of a relatively high level of sampling error. Sampling error estimates provide an indication of the degree to which random errors associated with the sampling process influence flight hour estimates. The level of sampling error is partly a function of the number of aircraft included in the survey sample. As sample size increases, sampling error decreases. Estimates of sampling error can be used to calculate confidence intervals for flight hour estimates within a particular category of flight operations. Estimated sampling error for 1999 public use flight activity (expressed in terms of a percent standard error) was 9.7, compared with much lower standard errors for personal (1.7), business (4.3), instructional (3.1), or corporate flight hours (5.5).[27] As a result, public use activity is being monitored with less accuracy than other major categories of aviation, reducing the accuracy with which trends in public aircraft accident rates can be examined.

Fifth, because of the way in which aircraft owners are asked to break down flight hours according to purpose of flight, the purpose of flight categories provided on the GA survey form are a mixture of flying tasks and administrative purposes of flight. Therefore, the categories are not mutually exclusive. For example, a private contractor performing aerial application work must choose between "aerial application" and "business transportation." Similarly, a government aircraft operator performing public health sprayings for mosquito control faces a choice between "other aerial application" (which includes public health spraying) and "public use." No instructions are provided to help the respondent choose between categories. It is doubtful that all aircraft owners faced with the same choice would make the same classification.

The limitations of the GA survey are recognized by those close to the sampling and activity estimation process but are less apparent to other users of the data, such as researchers acquiring accident rate statistics through the U.S. Department of Transportation's Bureau of Transportation Statistics. In an effort to improve the quality of GA data, a joint government/industry committee, the General Aviation Data Improvement Team (GADIT) was organized in April 2000. GADIT was organized into several breakout groups, one of which (the Activity Data Task Group) was directed to examine current FAA procedures for estimating GA activity data and to look for ways to improve the quality and timeliness of these estimates.[28] The Activity Data Task Group presented recommendations to the FAA Safer Skies Joint Steering Committee (a government/industry working group) in May 2001. However, due to differences in opinion among members of the committee, consideration of these recommendations was

[27] Federal Aviation Administration Office of Aviation Policy and Plans, *General Aviation and Air Taxi Activity Survey* (Washington, DC: FAA, 1999).

[28] There have been previous efforts by industry to improve the data. The General Aviation Coalition submitted recommendations to the FAA in 1997.

deferred. No action was taken and no date was set for further consideration of these recommendations.

Most of the GADIT Activity Data Task Group's recommendations focused on the improvement of existing survey process (clarifying purpose-of-flight definitions, adding questions, increasing sample size). There were, however, three recommendations to "enhance" the Civil Aviation Registry. These included asking each owner to periodically respond to address verification requests, even if the address had not changed; making registration mandatory every 3 years (one-third of the owners each year) and requiring completion of the GA survey when registration is filed; or having the registry provide voluntary revalidation of aircraft registration. The task group did not favorably assess alternate data collection methods. These included a suggestion supported by a minority opinion filed with the group's report that would require FAA airworthiness inspectors to submit a record of flight hours on an aircraft when it receives an annual inspection.

Federal Public Use Operations

The Safety Board obtained Federal aircraft activity data from the GSA Aircraft Management Policy Division. The GSA has been responsible for collecting information on Federal aircraft ownership, utilization, and cost accounting since 1989, as directed by OMB Circular A-126. Rather than surveying by mail, the GSA collects complete records of activity from Federal agencies. Seventeen Federal agencies currently report these data to the GSA (table 5).[29] In recent years, these agencies have submitted total annual flight hours statistics, broken down according to whether the aircraft used were federally owned, leased, or chartered. However, the GSA began collecting more detailed Federal aircraft activity data using a new Internet-based reporting system called the Federal Aviation Interactive Reporting System (FAIRS) in April 2000. FAIRS will provide easily accessible quarterly reports of cost and utilization data, as well as flight hours coded according to aircraft class and mission characteristics. The first complete year of FAIRS activity data will be available after the end of calendar year 2001. The FAIRS system will also contain a complete census of Federal aircraft by the end of 2001. Eleven mission category codes are being used to categorize flight hours in the FAIRS system (table 6), with more detailed subcategories available within these categories.

[29] The number of reporting agencies can change from year to year depending on aircraft utilization.

Table 5. Federal agencies reporting aircraft activity data to the U.S. General Services Administration for the year 1999.[a]

Agency or Department	Number of government-owned aircraft	Hours flown: government aircraft	Hours flown: contract, charter, rental	Hours flown: total
1. Department of Agriculture	365	19,920	78,348	98,268
2. Department of Commerce	14	3,708		3,708
3. Department of Energy	29	8,980	1,047	10,027
4. Department of Health and Human Services			1,371	1,371
5. Department of Housing and Urban Development				
6. Department of Justice	321	102,094	10,449	112,543
7. Department of State	98	19,933		19,933
8. Department of the Interior	107	21,574	52,852	74,426
9. Department of the Treasury	145	36,009		36,009
10. Department of Transportation	46	21,398	22,347	43,745
11. Department of Veterans Affairs			7	7
12. Environmental Protection Agency			678	678
13. Federal Emergency Management Agency[b]				
14. National Aeronautics and Space Administration	104	2,310		2,310
15. National Transportation Safety Board			21	21
16. National Science Foundation	14	4,002	1,858	5,860
17. Tennessee Valley Authority	11	2,486	81	2,567
Total	**1,254**	**242,414**	**169,059**	**411,473**

[a] These data are preliminary. They were obtained from the U.S. General Services Administration, Aircraft Management Policy Division. These flight hour data were collected prior to the implementation of GSA's Federal Aviation Interactive Reporting System (FAIRS) in April 2000, making it impossible to subdivide hours according to the type of aircraft flown or purpose of flight.

[b] Flight hours for the Federal Emergency Management Agency were unavailable for calendar year 1999.

Table 6. Purpose-of-flight codes used to categorize Federal aircraft flight activity in U.S. General Services Administration's Federal Aviation Interactive Reporting System (FAIRS).[a]

Category
1. Fire fighting and disaster response
2. Flight inspection / calibration
3. Law enforcement
4. Mission support
5. Research and development, including scientific experimentation
6. Resource management
7. Search and rescue
8. Surveillance
9. Training
10. Transportation of cargo
11. Transportation of passengers

[a] This list of mission categories was obtained from the U.S. General Services Administration (GSA), Aircraft Management Policy Division. The GSA began using these categories for collection of aircraft activity data during the 2000 calendar year. The first complete calendar year of FAIRS data will be 2001.

Prior to the implementation of FAIRS, Federal agencies submitted brief annual activity reports to the GSA for the years 1998 and 1999. These reports categorized flight hours according to the type of financial arrangement (government-owned aircraft, contract, charter, or rental). However, these reports provided no categorization of flying activity by aircraft class or mission type. Prior to 1998, Federal agencies reported flight hours to the GSA using the Federal Aviation Management Information System (FAMIS). FAMIS records provided much of the same information that will now be reported through FAIRS, but the FAMIS information was stored in a way that made it very difficult to access and analyze. In addition, FAMIS data were generally inaccurate, incomplete, and late.[30]

Federal government aircraft activity figures are shown in table 7. For the purposes of this study, the Safety Board collected Federal public aircraft activity data for the years 1996–1997 from agency FAMIS submissions and for 1998–1999 from the annual flight hour summaries submitted to the GSA by Federal agencies after the FAMIS was shut down. The GSA collects activity data on all aircraft operations sponsored by Federal executive agencies without distinguishing which flight hours were accrued as part of qualifying public aircraft missions. Therefore, flight hours for Federal government aviation operations are an inflated substitute for the Federal public aircraft flight hours they include. The GSA flight hour data, however, are currently the closest available estimate of Federal public aircraft activity.

Table 7. Public aircraft flight hours, 1996–1999.[a]

Year	Public use flight hours (all levels of government)	Federal aircraft flight hours (Federal aircraft only)
1996	1,047,000	341,000
1997	1,096,000	383,000
1998	1,373,000	417,000
1999	1,107,000	411,000
Total	**4,623,000**	**1,552,000**

[a] Activity estimates for all levels of government were obtained from the Federal Aviation Administration Office of Aviation Policy and Plans. Activity estimates for Federal aircraft were obtained from the General Services Administration Office of Aircraft Management Policy. Federal aircraft hours were adjusted for the years 1996–1998 by subtracting hours flown by the U.S. Coast Guard, which were included in GSA estimates during this period. U.S. Coast Guard flight hours were obtained from the U.S. Department of Transportation Office of Surface Transportation.

[30] President's Council on Integrity and Efficiency, *Combined Report on the Federal Civilian Agencies' Aircraft Management Programs*, Report Number A43006/O/W/F97011 (Washington, DC: PCIE, December 16, 1996).

Chapter 3

Accident Rates

Safety Board staff calculated an accident rate of 3.66 per 100,000 flight hours for all public aircraft operations, and 4.58 per 100,000 flight hours for Federal aircraft operations, for the period 1996–1999 (tables 8 and 9). Although the 4-year accident rate is higher for all public aircraft than for Federal aircraft, it is difficult to draw firm conclusions about the difference between the rates. The activity estimates used to calculate each accident rate contain unknown proportions of nonpublic government aircraft flight hours. In addition, as described in chapter 2, there are several aspects of the FAA's processes for estimating public use flight hours that are likely to introduce nonsampling error to the FAA's public use activity estimates. Furthermore, during the most recent year for which data were available (1999), the Federal public aircraft accident rate (2.92) was lower than the overall public aircraft accident rate (3.70).

Table 8. Public aircraft accident rates (all levels of government), 1996–1999.[a]

Year	Flight hours	Accidents	Fatal accidents	Nonfatal accidents	Accidents per 100K hours	Fatal accidents per 100K hours	Nonfatal accidents per 100K hours
1996	1,047,000	42	6	36	4.01	0.57	3.44
1997	1,096,000	41	9	32	3.74	0.82	2.92
1998	1,373,000	45	14	31	3.28	1.02	2.26
1999	1,107,000	41	6	35	3.70	0.54	3.16
Total	**4,623,000**	**169**	**35**	**134**	**3.66**	**0.76**	**2.90**

[a] Public and general aviation aircraft accidents were identified by the Safety Board using the Safety Board's aviation accident/ incident database. Multiple-aircraft accidents were counted as a single event. Public aircraft flight hours were obtained from the U.S. Federal Aviation Administration Office of Aviation Policy and Plans.

Table 9. Federal aircraft accident rates, 1996–1999.[a]

Year	Flight hours	Accidents	Fatal accidents	Nonfatal accidents	Accidents per 100K hours	Fatal accidents per 100K hours	Nonfatal accidents per 100K hours
1996	341,000	22	1	21	6.46	0.29	6.16
1997	383,000	14	5	9	3.65	1.31	2.35
1998	417,000	23	8	15	5.52	1.92	3.60
1999	411,000	12	1	11	2.92	0.24	2.68
1996–1999	1,550,000	71	15	56	4.58	0.97	3.61

[a] Federal and aircraft accidents were identified by the Safety Board using the Safety Board's aviation accident/incident database. Multiple-aircraft accidents were counted as a single event. Accidents involving the Civil Air Patrol and privately owned aircraft contracted to the Department of Defense were excluded from this table, because the flight activity of these operators was not included in Federal flight activity estimates. Federal aircraft flight hours were obtained from the U.S. General Services Administration, Office of Governmentwide Policy. Federal aircraft hours were adjusted for the years 1996–1998 by subtracting hours flown by the U.S. Coast Guard, which were included in GSA estimates during this period. U.S. Coast Guard flight hours were obtained from the U.S. Department of Transportation Office of Surface Transportation.

Safety Board staff calculated 1996–1999 accident rates for several categories of civil aviation (GA, air taxi operations, scheduled 14 CFR Part 135 operations, and scheduled 14 CFR Part 121 operations) to provide context for interpreting the public aircraft accident rates. Subrates were also calculated within some of these sectors for four combinations of aircraft category (rotorcraft versus fixed-wing) and accident severity (fatal vs. nonfatal) (table 10). Subrates were not calculated by aircraft category for scheduled Part 135 or scheduled Part 121 operations because activity data were not available at this level of detail from the FAA.

Table 10. Accident rates by aviation sector, aircraft category, and accident severity, 1996–1999.[a]

Aviation sector Aircraft category, accident severity	Accidents[b]	Flight hours[b]	Accidents per 100,000 flight hours
General aviation:	7,578	105,190,000	7.20
Rotorcraft, fatal accidents	115	4,991,000	2.30
Rotorcraft, nonfatal accidents	561	4,991,000	11.24
Fixed-wing, fatal accidents	1,268	89,442,000	1.42
Fixed-wing, nonfatal accidents	5,376	89,442,000	6.01
Public aircraft:	169	4,623,000	3.66
Rotorcraft, fatal accidents	16	1,929,000	0.83
Rotorcraft, nonfatal accidents	77	1,929,000	3.99
Fixed-wing, fatal accidents	18	2,536,000	0.71
Fixed-wing, nonfatal accidents	54	2,536,000	2.13
Air taxi:	322	9,290,000	3.47
Rotorcraft, fatal accidents	14	2,201,000	0.64
Rotorcraft, nonfatal accidents	33	2,201,000	1.50
Fixed-wing, fatal accidents	59	6,690,000	0.88
Fixed-wing, nonfatal accidents	217	6,690,000	3.24
Scheduled Part 135:[c d]	48	4,545,000	1.06
Fatal accidents	11	4,545,000	0.24
Nonfatal accidents	37	4,545,000	0.81
Scheduled Part 121:[c]	166	60,513,000	0.27
Fatal accidents	9	60,513,000	0.01
Nonfatal accidents	157	60,513,000	0.26

[a] Aircraft accidents were identified by the Safety Board using the Safety Board's aviation accident/incident database. Multiple-aircraft accidents were counted as a single event. Aircraft flight hours were obtained from the U.S. Federal Aviation Administration, Office of Aviation Policy and Plans, Planning Analysis Division.

[b] Gliders, lighter-than-air craft, and ultralights were not included in fixed-wing accident totals. Autogyros were not included in rotorcraft accident totals. In addition, multiple aircraft accidents within a sector sometimes involved both a rotorcraft and a fixed-wing aircraft. In these cases, the accident was counted once in each aircraft category. For these reasons, the sum of fixed-wing and rotorcraft accidents does not add to the total number of accidents within each sector.

[c] Flight hours were not available by aircraft category for scheduled 14 CFR Part 135 and scheduled 14 CFR Part 121 operations.

[d] Many scheduled 14 CFR Part 135 operators transitioned to operation under 14 CFR Part 121 in 1997 because of a change in the Federal Aviation Regulations governing passenger service.

At the broadest level of analysis, the accident rate for all public aircraft for the years 1996–1999 (3.66 accidents per 100,000 flight hours) lies between the rate for GA (7.20 accidents per 100,000 flight hours) and the rates for scheduled Part 135 and Part 121 operations (1.06 and 0.27, respectively). The accident rate for public aircraft (3.66) was almost identical to the rate for air taxis (nonscheduled Part 135 operations, 3.47 accidents per 100,000 flight hours) (table 10 and figure 2). Again, any conclusions about the differences between these accident rates must be considered tentative because it is

difficult to estimate the combined effects of sampling and nonsampling error that affect FAA flight hour estimates within these categories.

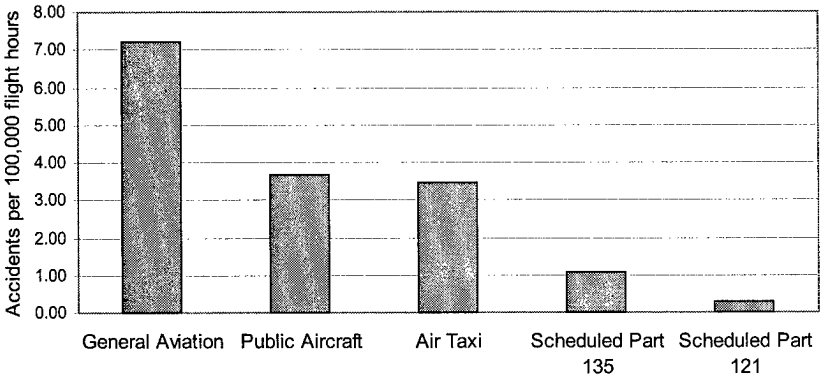

Figure 2. Accident rates by aviation sector, 1996–1999

To examine how much the public aircraft flight hours might be affected by sampling error alone, Safety Board staff calculated a 90-percent confidence interval using sampling error statistics from the FAA's 1999 flight activity estimates.[31] The confidence interval for public use flight hours ranges ±16 percent (between 930,000 and 1,284,000). This means that the confidence interval for the 1999 public aircraft accident rate (3.70) actually ranges from 3.19 to 4.41. Staff lacked adequate data to calculate confidence intervals for the GA or air taxi accident rates because sampling error figures published by the FAA were not available at the desired level of analysis.[32] Even if the Board had been able to calculate confidence intervals for all of these accident rates, it would still be difficult to draw conclusions about the differences between public and civil aircraft accident rates because of the numerous sources of nonsampling error the Board believes may be influencing the FAA hour estimates (as discussed in chapter 2). Nevertheless, the effects of nonsampling error would have to be quite large to change the ranked order of the broad accident rates in each sector (as shown in figure 2), with the exception of the public and air taxi accident rates, which are quite similar.

The more detailed public, GA, and air taxi accident rates shown in table 10 generally show the same ordering as the overall rates, with public aircraft and air taxi rates both being substantially lower than GA. There is one exception, however. Although the rates for nonfatal public and GA rotorcraft accidents are both substantially lower than the rate for nonfatal GA rotorcraft accidents (2.12 for public and 4.93 for air taxi, compared with 13.55 for GA), the rate for nonfatal public rotorcraft accidents is more than double the rate for nonfatal air taxi rotorcraft accidents. Again, it is difficult to assess the significance of this difference due to the lack of data available for the calculation of confidence intervals for the rates involved.

[31] A 90-percent confidence interval represents the range within which one can be 90 percent confident that a statistic would lie if sampling could be performed without error.

[32] For example, three separate activity figures are routinely combined by the FAA and the NTSB to estimate air taxi flight activity: air taxi, air tours, and sightseeing. The FAA publishes an estimate of sampling error for each of these categories individually, but not for all three combined. The Board faced a similar dilemma when seeking to calculate confidence intervals for GA activity.

Chapter 4

Accident Characteristics

This chapter describes characteristics of public aircraft accidents. The reader is cautioned that the statistics presented in this chapter are not representative of all public aircraft flight operations, only accident flights. Accident flight characteristics likely differ from the nonaccident flight characteristics.

Statistics describing GA accident flights are presented alongside public aircraft accident statistics in some of the tables that follow. In addition, some tables provide more detailed breakdowns within each sector for rotorcraft versus fixed-wing aircraft.

The time frame for most of the analyses covers the period 1995–1998 rather than the period 1996–1999, because many of the variables analyzed in this chapter are not entered in the Safety Board database until an accident investigation is completed and many of the accident investigations begun in 1999 had not yet been completed at the time this report was prepared.

Accident Location

Safety Board staff ranked States according to the number of public aircraft accidents reported during the 1993–2000 period. This ranking indicated that California, Alaska, Florida, and Texas were in the top four. These four States accounted for 46 percent of all public aircraft accidents. These were also the top four States for GA accidents during the 1993–2000 period.

The concentration of nearly half of all public aircraft accidents in four States probably reflects the magnitude of flying activity within those States. Since the FAA does not estimate aircraft activity by State, it would be very difficult to analyze the extent to which the concentration of accidents is merely a function of flight activity. The percentage of public aircraft accidents by State is shown graphically in figure 3.

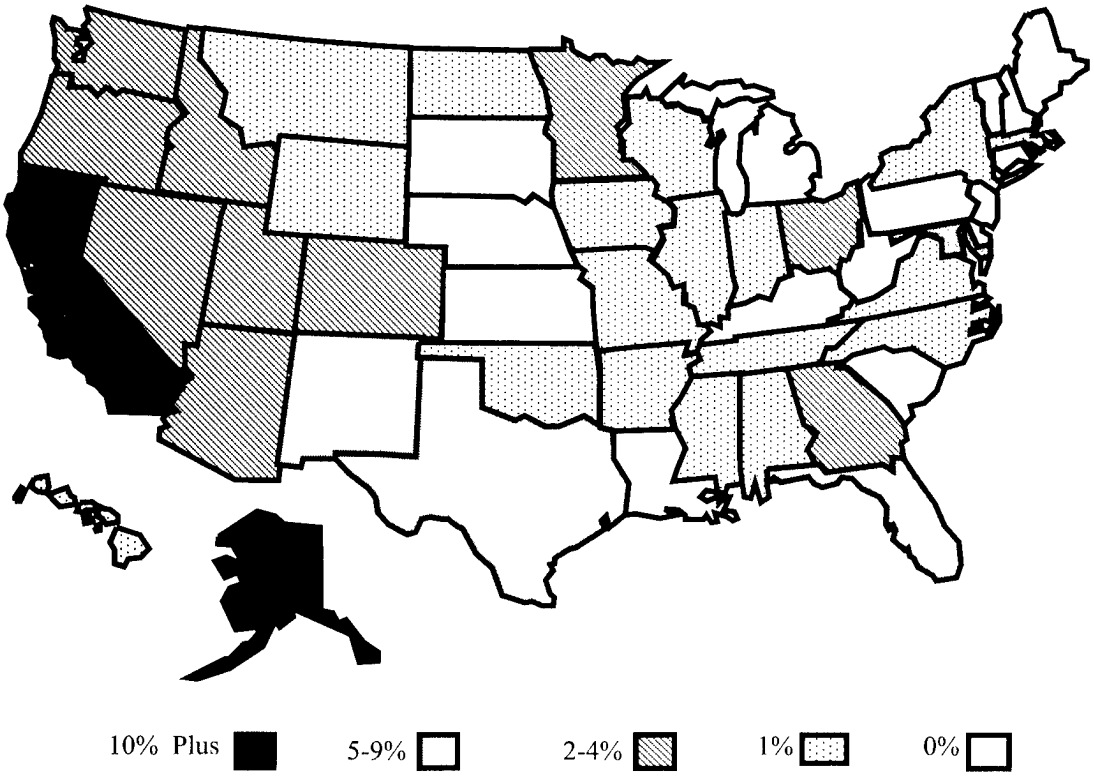

Figure 3. Percent of all U.S. public aircraft accidents occurring within each State.

Trends and Seasonal Components

Staff analyzed trends and seasonal patterns affecting public aircraft accidents during the study period as well. These analyses indicated that the annual number of public aircraft accidents has remained stable over the last 8 years. No significant upward or downward trend was evident (figure 4). The analyses revealed substantial seasonal influences that affected public aircraft accident totals from month to month, with accidents peaking in June and reaching their seasonal low in December. The seasonal pattern looks very similar to that of GA (figure 5).

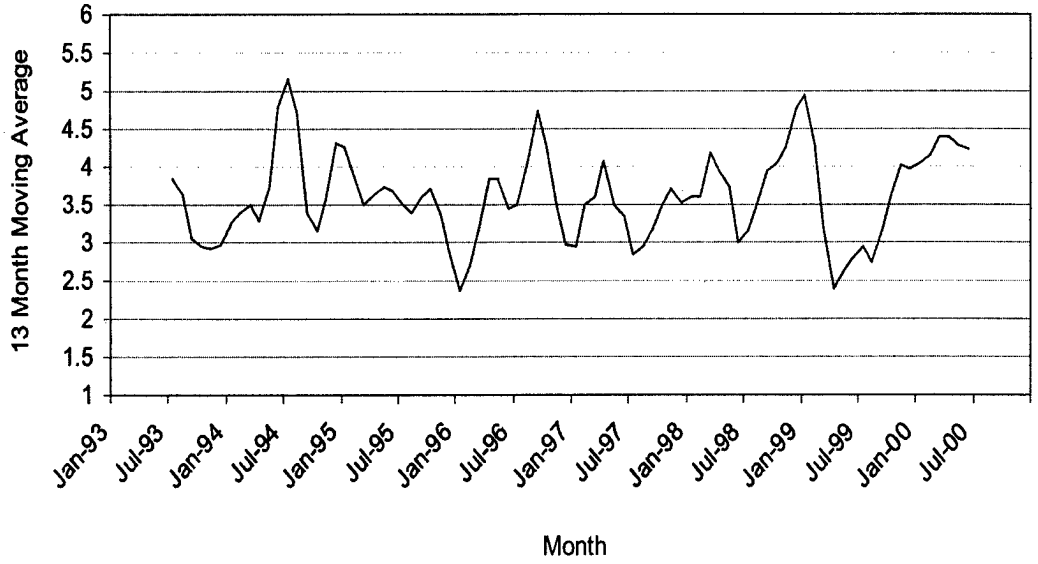

Figure 4. Public aircraft accident trend, July 1993–June 2000. Trend line based on a 13-month moving average, which removes seasonal effects. The first and last data points were not plotted, due to distortion from the averaging process.

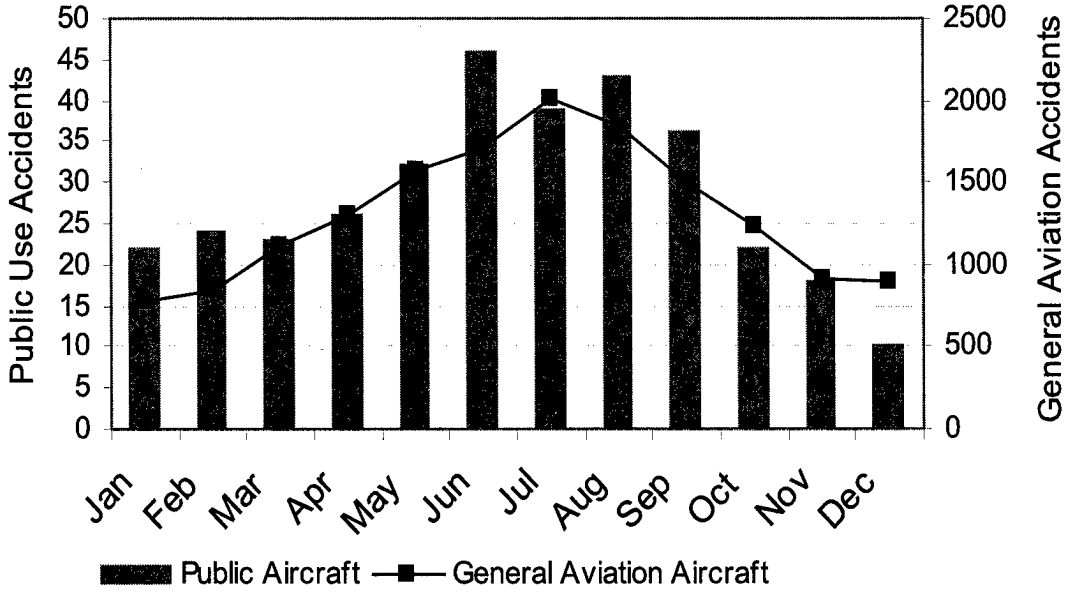

Figure 5. Public versus general aviation accidents–seaonal factors. Data shown are the number of accidents occurring within each calendar month from January 1993 through December 2000. Accidents involving multiple aircraft were counted as a single event.

Aircraft Category

Accident aircraft are totaled by category (for example, airplane with single reciprocating engine, airplane with multiple reciprocating engines, etc.) in table 11. A higher proportion of public accident aircraft were rotorcraft (47 percent for public aircraft versus 7 percent for GA, respectively). This likely reflects the higher proportion of helicopters performing public use flights, which, according to the 1999 GA survey, generated 49 percent of all public use flight hours, but only 1.6 percent of GA flight hours.

Table 11. Public versus general aviation accident aircraft by category.[a]

Aircraft category	Public aircraft		General aviation aircraft	
	Aircraft	Percent	Aircraft	Percent
Airplanes:				
Single reciprocating	69	40	5,903	77
Multiple reciprocating	10	6	537	7
Turboprop	6	3	209	3
Turbojet	1	1	73	1
Unknown airplane	4	2	84	1
Total	**90**	**52**	**6,806**	**89**
Rotorcraft:				
Reciprocating	21	12	324	4
Turboshaft	58	33	238	3
Unknown rotorcraft	2	1	5	0
Total	**81**	**47**	**567**	**7**
Other aircraft	3	2	270	4
All Aircraft	174	100	7,643	100

a Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Some percent columns may not add to 100 because of rounding.

Local Versus Point-to-Point

Accident aircraft totals are presented in table 12 according to whether the accident flight was local versus point-to-point. Approximately 64 percent of public accident aircraft were engaged in local flying, compared to only 48 percent of GA accident aircraft. Furthermore, local public aircraft accident flights were more likely than local GA accident flights to have crashed at an off-airport location. Neither of these findings is particularly surprising, considering the kinds of missions flown by public aircraft operators.

Table 12. Type of flight.[a]

Type of flight	Public aircraft		General aviation aircraft	
	Aircraft	Percent	Aircraft	Percent
Local				
At airport	28	16	1,642	21
Off airport	83	48	2,113	27
Total	**111**	**64**	**3,755**	**48**
Point-to-point				
Destination	39	22	1,930	25
Origin	13	7	870	11
En route	11	6	1,271	16
Total	**63**	**36**	**4,071**	**52**
Total	**174**	**100**	**7,826**	**100**

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis.

First Occurrence

When accidents investigated by the Safety Board are entered into the database, "occurrences" (categories of events leading to the damage or injury) are coded. Staff sorted occurrence codes into broad categories and counted the number of public versus GA accident aircraft associated with each category. These aircraft were further grouped in terms of their involvement in fatal versus nonfatal accidents (table 13). The only noteworthy difference between the two sectors involved in-flight collisions. A higher proportion of fatal public aircraft accidents began with an in-flight collision (46 percent for public aircraft versus 29 percent for GA aircraft (table 13). Followup analyses did not reveal any obvious difference between the two sectors in terms of the type of collision (for example, collision with terrain, tree, power line, utility pole, and so on). However, when broken down to this level of detail, the number of accidents in each category was too small to make valid comparisons.

Table 13. Public versus general aviation accident aircraft by first occurrence, all aircraft categories.[a]

	Public aircraft				General aviation aircraft			
First occurrence	Fatal	Percent total	Non-fatal	Percent total	Fatal	Percent total	Non-fatal	Percent total
Collision:								
In-flight	18	47	18	14	425	29	801	13
On ground/water			7	5	4	0	431	7
Noncollision:								
In-flight	15	39	27	21	711	49	1,140	18
Power-related	5	13	37	29	247	17	1,949	32
On ground/water			34	27	32	2	1,596	26
Miscellaneous			4	3	22	2	118	2
Gear-related			1	1	1	0	145	2
Unknown					14	1	2	0
Total	**38**	**100**	**128**	**100**	**1,456**	**100**	**6,182**	**100**

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Some percent columns may not add to 100 because of rounding.

Because public use aircraft accidents involve a higher proportion of rotorcraft than accidents in other sectors of aviation, staff conducted the same analysis using two subsets of the accident data presented in table 12 (rotorcraft only (table 14) and fixed-wing aircraft only (table 15).

Table 14. Public versus general aviation accident aircraft by first occurrence, rotorcraft only.[a]

	Public rotorcraft				General aviation rotorcraft			
First occurrence	Fatal	Percent total	Non-fatal	Percent total	Fatal	Percent total	Non-fatal	Percent total
Collision:								
In-flight	3	21	10	16	30	30	94	18
On ground/water			5	8			12	2
Noncollision:								
In-flight	8	57	17	27	47	47	169	32
Power-related	3	21	22	34	18	18	160	30
On ground/water			7	11	3	3	80	15
Miscellaneous			2	3	1	1	15	3
Gear-related			1	2			2	0
Unknown								
Total	**14**	**100**	**64**	**100**	**99**	**100**	**532**	**100**

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Some percent columns may not add to 100 as a result of rounding error.

Table 15. Public versus general aviation accident aircraft by first occurrence, fixed-wing aircraft only.[a]

	Public fixed-wing aircraft				General aviation fixed-wing aircraft			
First occurrence	Fatal	Percent total	Non-fatal	Percent total	Fatal	Percent total	Non-fatal	Percent total
Collision:								
In-flight	15	63	6	10	390	30	641	12
On ground/water			2	3	4	0	398	7
Noncollision:								
In-flight	7	29	9	15	633	48	901	17
Power-related	2	8	15	25	227	17	1,783	33
On ground/water			27	44	28	2	1,471	27
Miscellaneous			2	3	19	1	78	1
Gear-related					1	0	142	3
Unknown					14	1	2	0
Total	**24**	**100**	**61**	**100**	**1,316**	**100**	**5,416**	**100**

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Some percent columns may not add to 100 because of rounding.

Phase of Flight

Staff also examined the frequency with which public aircraft accident sequences began in different phases of flight (see table 16). Staff observed the following significant differences between the two sectors. Both fatal and nonfatal public aircraft accidents were more likely than GA accidents to have occurred during a maneuvering phase of flight (42 percent of public aircraft versus 26 percent for GA aircraft involved in fatal accidents, 20 percent for public aircraft versus 10 percent for GA aircraft for nonfatal accidents).

Table 16. Public versus general aviation accident aircraft by phase of flight for first occurrence, all aircraft categories.[a]

	Public aircraft				General aviation aircraft			
Phase of flight	**Fatal**	**Percent**	**Non-fatal**	**Percent**	**Fatal**	**Percent**	**Non-fatal**	**Percent**
Cruise	12	32	15	12	385	26	869	14
Maneuvering	16	42	26	20	384	26	607	10
Approach	4	11	9	7	228	16	762	12
Takeoff	3	8	22	17	212	15	1,346	22
Climb	1	3	1	1	84	6	160	3
Descent					45	3	148	2
Landing			37	29	34	2	1,892	31
Hover	1	3	9	7	11	1	78	1
Standing			5	4	9	1	71	1
Other			1	1	8	1	6	0
Taxi			4	3	3	0	205	3
Uncontrolled descent					2	0	9	0
Emergency landing					1	0	16	0
Holding							1	0
Unknown	1	3			50	3	12	0
Total	**38**	**100**	**129**	**100**	**1,456**	**100**	**6,182**	**100**

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Some percent columns may not add to 100 because of rounding.

Again, staff performed the same analysis after limiting the sample first to rotorcraft, then to fixed-wing aircraft. Again, sample size and statistical power were limited. Analyses failed to confirm the same result in these more restricted samples, although the proportions lay in the same direction (tables 17 and 18).

Table 17. Public versus general aviation accident aircraft by phase of flight for first occurrence, rotorcraft only.[a]

	Public rotorcraft				General aviation rotorcraft			
Phase of flight	Fatal	Percent	Non-fatal	Percent	Fatal	Percent	Non-fatal	Percent
Cruise	2	14	10	16	27	27	87	16
Maneuvering	7	50	19	30	34	34	126	24
Approach	1	7	2	3	5	5	44	8
Takeoff	2	14	9	14	9	9	66	12
Climb	1	7			3	3	9	2
Descent					4	4	7	1
Landing			10	16	1	1	91	17
Hover	1	7	9	14	11	11	77	14
Standing			5	8	1	1	14	3
Other							1	0
Taxi							5	1
Uncontrolled descent							4	1
Emergency landing							1	0
Holding								
Unknown					4	4		
Total	**14**	**100**	**64**	**100**	**99**	**100**	**532**	**100**

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Some percent columns may not add to 100 because of rounding.

Table 18. Public versus general aviation accident aircraft by phase of flight for first occurrence, fixed-wing aircraft only.[a]

	Public fixed-wing aircraft				General aviation fixed-wing aircraft			
Phase of flight	Fatal	Percent	Non-fatal	Percent	Fatal	Percent	Non-fatal	Percent
Cruise	10	42	5	8	353	27	760	14
Maneuvering	9	38	7	11	339	26	458	8
Approach	3	13	7	11	215	16	676	12
Takeoff	1	4	11	18	197	15	1,233	23
Climb			1	2	76	6	150	3
Descent					40	3	132	2
Landing			26	42	31	2	1,717	32
Hover							1	0
Standing					8	1	53	1
Other			1	2	8	1	5	0
Taxi			4	6	3	0	198	4
Uncontrolled descent					2	0	5	0
Emergency landing							15	0
Holding							1	0
Unknown	1	4			46	3	12	0
Total	**24**	**100**	**62**	**100**	**1,318**	**100**	**5,416**	**100**

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Some percent columns may not add to 100 because of rounding.

Causes or Contributing Factors

The proportions of accidents due to the broadest categories of aircraft-related, environment-related, and pilot-related factors were virtually identical for public and GA accident aircraft. Accident aircraft counts, grouped by categories of causal factors are shown in table 19. The most common causes or related factors reported by accident investigators for both public and GA accident aircraft were pilot-related (83 percent for fatal public aircraft accidents versus 88 percent for fatal GA accidents), followed by environment-related and aircraft-related factors.

Table 19. Public versus general aviation cause and contributing factor categories by accident severity, all aircraft types.[a]

	Public aircraft				General aviation aircraft			
Cause/contributing factor	Fatal	Percent total	Nonfatal	Percent total	Fatal	Percent total	Nonfatal	Percent total
All aircraft factors:	9	24	39	31	331	23	2,053	34
Propulsion controls	4	11	27	22	199	14	1,463	24
Flight controls					27	2	100	2
Airframe	1	3	1	1	51	4	72	1
Landing gear			7	6	4	0	253	4
Systems	4	11	6	5	65	5	251	4
All environment factors:	17	46	67	54	591	42	2,771	46
Weather	9	24	30	24	404	29	1,223	20
Light conditions	4	11	7	6	170	12	232	4
Object	1	3	12	10	84	6	457	8
Airport facilities	1	3	2	2	12	1	48	1
Terrain or runway conditions	7	19	35	28	150	11	1,410	23
All personnel factors:	35	95	106	85	1,353	96	5,150	85
Pilot	31	84	96	77	1,276	90	4,740	78
Others aboard	1	3	4	3	24	2	47	1
Others not aboard	14	38	13	10	179	13	543	9
Accidents with at least one known cause/factor	37	100	124	100	1,413	100	6,055	100

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Percent columns do not add to 100 because more than one category of causes or related factors could be counted for a single accident. However, multiple causal factors in a single category for a single accident were only counted once.

The same analyses were repeated for rotorcraft (table 20) and fixed-wing aircraft (table 21), with similar results.

Table 20. Public versus general aviation cause and contributing factor categories by accident severity, rotorcraft only.[a]

	Public rotorcraft				General aviation rotorcraft			
Cause/contributing factor	Fatal	Percent total	Nonfatal	Percent total	Fatal	Percent total	Nonfatal	Percent total
All aircraft factors:	6	46	22	35	37	38	207	39
Propulsion controls	3	23	16	25	23	23	155	30
Flight controls					5	5	20	4
Airframe	1	8			3	3	9	2
Landing gear			2	3			7	1
Systems	2	15	6	10	7	7	35	7
All environment factors:	8	62	31	49	36	37	181	34
Weather	3	23	10	16	19	19	64	12
Light conditions	3	23	5	8	11	11	21	4
Object			6	10	8	8	35	7
Airport facilities	1	8	1	2	1	1	2	0
Terrain or runway conditions	3	23	17	27	11	11	94	18
All personnel factors:	11	85	49	78	89	91	440	84
Pilot	8	62	41	65	74	76	375	71
Others aboard			4	6	1	1	10	2
Others not aboard	6	46	9	14	27	28	81	15
Accidents with at least one known cause/factor	13	100	63	100	98	100	525	100

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Percent columns do not add to 100 because more than one category of causes or related factors could be counted for a single accident. However, multiple causal factors in a single category for a single accident were only counted once.

Table 21. Public versus general aviation cause and contributing factor categories by accident severity, fixed-wing aircraft only.[a]

Cause/contributing factor	Public fixed-wing aircraft				General aviation fixed-wing aircraft			
	Fatal	Percent total	Nonfatal	Percent total	Fatal	Percent total	Nonfatal	Percent total
All aircraft factors:	3	13	16	26	282	22	1,810	34
Propulsion controls	1	4	11	18	173	13	1,301	24
Flight controls					18	1	73	1
Airframe					45	3	56	1
Landing gear			5	8	4	0	246	5
Systems	2	8			56	4	202	4
All environment factors:	9	38	34	56	550	42	2,478	46
Weather	6	25	20	33	380	29	1,083	20
Light conditions	1	4	2	3	159	12	207	4
Object	1	4	5	8	75	6	398	7
Airport facilities			1	2	11	1	46	1
Terrain or runway conditions	4	17	17	28	137	10	1,284	24
All personnel factors:	24	100	54	89	1,228	94	4,495	84
Pilot	23	96	52	85	1,168	89	4,167	78
Others aboard	1	4			22	2	27	1
Others not aboard	8	33	4	7	146	11	445	8
Accidents with at least one known cause/factor	24	100	61	100	1,310	100	5,359	100

[a] Accident aircraft were identified using the Safety Board's aviation accident/incident database. Data for the period 1995–1998 were included in this analysis. Percent columns do not add to 100 because more than one category of causes or related factors could be counted for a single accident. However, multiple causal factors in a single category for a single accident were only counted once.

Pilot Certification

Accident-involved public aircraft pilots were very different from accident-involved GA pilots in terms of pilot certification (table 22). Accident-involved public aircraft pilots were more highly qualified than accident-involved GA aircraft pilots in that they were more likely to hold a commercial pilot rating (64 percent for public versus 36 percent for GA) and they were more likely to hold an airline transport pilot rating (24 percent for public versus 12 percent for GA).

Table 22. Highest rating for accident-involved pilots-in-command.[a]

Highest rating	Public aircraft Pilots-in-command		General aviation aircraft Pilots-in-command	
	Pilots	Percent of pilots	Pilots	Percent of pilots
Airline transport pilot	41	24	877	12
Commercial	109	64	2,740	36
Private	18	11	3,419	45
Student	1	1	576	8

[a] Accident aircraft pilots were identified using the Safety Board's aviation accident/incident database. Figures in this table were based on accident data for the period 1995–1998.

In addition, accident-involved public aircraft pilots were more likely than accident-involved GA pilots to hold an instrument rating (78 percent for public versus 50 percent for GA) (table 23).

Table 23. Type of instrument rating for accident involved pilots-in-command.[a]

Instrument rating held	Public aircraft Pilots-in-command		General aviation aircraft Pilots-in-command	
	Pilots	Percent of pilots	Pilots	Percent of pilots
Any instrument rating	135	78	3,918	50
Airplane	114	66	3,628	46
Helicopter	49	28	338	4
No instrument rating	39	22	3,908	50

[a] Accident-involved pilots were identified using the Safety Board's aviation accident/incident database. Ratings shown for pilots-in-command only. Figures in this table were based on accident data for the period 1995–1998.

Chapter 5

Analysis

The Safety Board compared the safety of public and civil aircraft by reviewing safety statistics on aircraft operations since 1993. The Board was hampered by a lack of available public aircraft activity estimates for years prior to 1996 and by the unreliability and lack of detail characterizing activity estimates published since that time. As a result, the Board can only offer tentative conclusions about the relative safety of public and civil aircraft. A comparison of public and GA aircraft accident rates, based on imprecise FAA activity estimates, revealed that during the period 1996–1999, public aircraft experienced fewer accidents per flight hour than GA aircraft, but more than aircraft performing scheduled operations under 14 CFR Part 135 or Part 121.

The Safety Board's concerns about the reliability and validity of the FAA's public aircraft activity estimates used to calculate the accident rates in this report are fivefold:

1. The definition of "public use" provided on GA survey forms used to collect the data for estimating public aircraft flight hours is broader than the statutory definition for public aircraft.
2. Accurate reporting of public use flight hours and purpose-of-flight information depends on the ability of aircraft owners, who may be one or more steps removed from the actual flying of the aircraft, to obtain detailed information about the aircraft's flying activities during the previous year.
3. Accurate public and civil aircraft flight hour estimates depend on the currency and accuracy of the FAA Civil Aviation Registry. However, it can be conservatively estimated that about 19 percent of registry records are outdated or incorrect, impeding flight activity sampling and estimation processes.
4. Too few public aircraft are sampled as part of the GA survey; as a result, sampling error is much higher for estimates of public aircraft flight hours than estimates for GA flying conducted for personal or business reasons.
5. The GA survey questionnaire is designed in a way that prevents the reporting or estimation of public aircraft flight hours according to purpose of flight.

The records and processes used to generate the FAA's annual flight hour estimates for public and civil aircraft are in need of several improvements.

First, because FAA estimates of public aircraft flight hours are based on a set of aircraft operations broader than those meeting the statutory definition of public aircraft operations, the FAA should revise the GA survey data collection system to more clearly distinguish between government aircraft operations that qualify for statutory public aircraft status and those that do not. This will allow the Safety Board and other government organizations to calculate more accurate public aircraft accident rates.

Second, the FAA should identify and implement methods of checking the accuracy of the information collected using the GA survey. The FAA's inability to sample as much as a quarter of the active GA fleet raises serious questions about the organization's ability to accurately estimate GA or public aircraft flight activity using a sample survey approach.[33] The reliance on aircraft owners to provide the desired information is subject to a number of weaknesses discussed in chapter 2. Although surveying owners may be the most practical means available for collecting nonairline flight activity data, the FAA should identify and implement methods independent of the GA survey that can be used to check the accuracy of nonairline flight hour estimates.

Third, the FAA should improve the accuracy and currency of the Civil Aviation Registry. The GADIT committee recently recommended that the FAA obtain address verification every 3 years by requiring a response to the triennial aircraft registration form, regardless of any change in an owner's registration information. Although this would represent a positive step, the Safety Board believes that it is insufficient to ensure the currency of the registry. It would do nothing to improve the 28,000 aircraft records that are known to contain outdated owner contact information. These individuals no longer receive triennial registration report forms because the FAA cannot contact them. The registry's effort to contact aircraft owners who have submitted a change of address form to the USPS and request updated contact information also represents a positive step, but the vast majority of owners so contacted fail to respond to the FAA. For these reasons, the Board is concerned that owner contact information in the registry will continue to deteriorate, further hampering the FAA's ability to estimate annual nonairline flight activity. The FAA should implement a program that will (a) measure and track the currency of aircraft owner contact information in the registry and (b) systematically improve the currency of this information in a measurable way.

Fourth, the FAA should reduce the sampling error associated with estimates of public use flying activity. Estimates for public use flying activity are currently less precise than estimates for major categories of GA activity (for example, business, personal, instructional, and so on). This results from differences in the number of aircraft sampled. This situation can be improved by sampling an increased number of aircraft that perform public aircraft operations. The FAA should revise the sampling strategy of the GA survey to achieve a precision of public use flight hour estimates (in terms of sampling error) that is equivalent to the precision of estimates for personal, business, or corporate subcategories of GA.

Finally, the FAA should revise the GA survey form so that operators can report public aircraft flight hours by purpose of flight. Purpose-of-flight categories should be mutually exclusive. Current categories mix administrative purposes of flight with flying activities. The FAA should develop a new reporting matrix on the GA survey form that separates the administrative purpose of flight (for example, personal, business, corporate, regional, air taxi, air tours, sightseeing, public use, air medical services, search and rescue,

[33] This figure—one quarter of the active fleet—includes known outdated or inaccurate records combined with the number of estimated outdated or inaccurate records yet to be verified. The figure is given in a memo written by the FAA's contractor for survey data analysis, PA Consulting, dated March 26, 2001.

and so on) from the actual flying activity performed (for example, transport of passengers, flight instruction, aerial observation, aerial application, external load, and so on). The FAA should incorporate these changes in published flight hour estimates as well.

In addition, the FAA should revise the GA survey so that aircraft owners can report public aircraft flight hours according to the level of government served (Federal, State, or local) within each purpose-of-flight category. This will make it possible to compare the safety of public aircraft operations sponsored by different levels of government.

An additional issue of interest involves the FAA's inclusion of CAP flight hours in annual public use flight activity estimates. CAP flight hours made up about 7 percent of the FAA's 1999 estimate of public use flight hours despite the fact that CAP flights are not considered public aircraft operations under current law. The inclusion of these hours inflates the FAA's annual estimate of public use flight activity. The CAP returned 14 surveys to the FAA for the 1999 GA survey. On these surveys, CAP personnel classified a total of 1,263 aircraft flight hours as public use. Based on the FAA's sample weighting factors for these aircraft, these surveys contributed 75,324 flight hours (7 percent) to the FAA's overall 1999 estimate of public use flight hours. The FAA should remove CAP flight hours from future estimates of public aircraft activity so that the figures are consistent with the current statutory definition of public aircraft.

With respect to Federal public aircraft activity data, the Safety Board applauds the steps the GSA has taken to improve collection of Federal aircraft activity data. Although Federal government operators have been reporting aircraft flight hours to the GSA in recent years, these data were reported by each agency only in an aggregate fashion. The GSA's new automated data entry and analysis system, FAIRS, should provide easily accessible activity and cost data at the level of specific aircraft with added ability to total flight hours according to mission characteristics and other factors. This system will provide a complete set of data describing Federal aircraft operations for 2001 and subsequent years. The FAIRS system, currently being deployed by the GSA, should enhance the GSA's ability to monitor Federal government aircraft activity and should allow the GSA to provide better information to other Federal agencies, including the Safety Board. The Safety Board encourages the GSA to finish the implementation of this system and take steps to ensure that it will function as intended. The Safety Board believes that the GSA should collect and maintain aircraft flight hour data from Federal agencies in such a way that it is possible to distinguish Federal public aircraft flight operations from other Federal government-sponsored flight operations.

A final concern involves the parallel development of activity data collection systems at the FAA and the GSA. It would be useful to compare the safety of Federal public aircraft versus other aircraft engaged in the same kinds of flying activities. However, the development of separate, independent activity data collection systems by the FAA and the GSA is leading to the collection of flight hour data in terms of incompatible categories of purpose of flight. This will make it difficult, if not impossible, to compare accident rates for Federal public aircraft versus other public aircraft for

specific kinds of flying activities. The GSA and the FAA should define purpose-of-flight categories in the FAIRS that correspond to purpose-of-flight categories in the GA survey.

The Safety Board last addressed deficiencies in nonairline flight activity estimates in its 1979 study, *Single-Engine Fixed-Wing General Aviation Accidents*.[34] In that study, the Safety Board analyzed accident rates for specific models of GA aircraft.[35] The analyses revealed large differences in model-specific accident rates, but the study's authors could not control for aircraft-specific differences in terms of pilot characteristics, region, or purpose of flight. This led to difficulty interpreting differences in model-specific accident rates. As a result, the Safety Board recommended that the FAA collect more detailed GA activity data so that more specific rates could be calculated and the safety performance of different aircraft types could be more carefully evaluated. The Board's recommendation was phrased as follows:

> Generate, through a stratified sampling of general aviation pilots, the date, duration, aircraft make and model, the geographical location of the flight, and the flight time in IFR, high density altitude, and wind conditions, all on a per flight basis; the data collected should include the pilot's total time, time in each type aircraft flown, age, occupation, certificate, and medical waivers. (A-79-44)

The FAA formed a committee in 1980 which sought to identify human factors/exposure data and the alternatives to acquiring such data. However, after the Safety Board attended several meetings with the FAA, it became clear that the FAA was not likely to take meaningful action related to recommendation A-79-44. The recommendation was classified "Closed-Unacceptable Action" by the Safety Board on December 1, 1986. However, detailed, accurate statistics describing flight activity remain crucial for monitoring the safety of general aviation and for monitoring the safety of air taxi and public aircraft operations as well.

[34] National Transportation Safety Board, *Single-Engine Fixed Wing General Aviation Accidents*, Aviation Special Study, NTSB/AAS-79/01 (Washington, DC: NTSB, 1979).

[35] This would not be possible today, because the FAA no longer collects flight hours for specific aircraft models.

Conclusions

As a result of this safety study, the National Transportation Safety Board draws the following conclusions:

1. A comparison of public and general aviation aircraft accident rates, based on imprecise FAA activity estimates, revealed that, during the period 1996–1999, public aircraft experienced fewer accidents per flight hour than general aviation aircraft, but more than aircraft performing scheduled operations under 14 CFR Part 135 or Part 121.

2. About 64 percent of public accident aircraft were engaged in local flying, compared to only 48 percent of general aviation accident aircraft. Furthermore, local public aircraft accident flights were more likely than local general aviation accident flights to have crashed at an off-airport location.

3. A higher proportion of fatal public aircraft accidents began with an in-flight collision (46 percent for public aircraft versus 29 percent for general aviation aircraft).

4. Both fatal and nonfatal public aircraft accidents were more likely than general aviation accidents to have occurred during a maneuvering phase of flight (42 percent of public aircraft versus 26 percent for general aviation aircraft involved in fatal accidents, 20 percent for public aircraft versus 10 percent for general aviation aircraft for nonfatal accidents).

5. The most common causes or related factors reported by accident investigators for both public and general aviation accident aircraft were pilot-related (83 percent for fatal public aircraft accidents versus 88 percent for fatal general aviation accidents), followed by environment-related and aircraft-related factors.

6. Accident-involved public aircraft pilots were more highly qualified than accident-involved general aviation aircraft pilots in that they were more likely to hold a commercial pilot rating (64 percent for public versus 36 percent for general aviation) and they were more likely to hold an airline transport pilot rating (24 percent for public versus 12 percent for general aviation).

7. Accident-involved public aircraft pilots were more likely than accident-involved general aviation pilots to hold an instrument rating (78 percent for public versus 50 percent for general aviation).

8. The definition of "public use" provided on General Aviation and Air Taxi Activity Survey forms used to collect the data for estimating public aircraft flight hours is broader than the statutory definition for public aircraft.

9. Accurate reporting of public use flight hours and purpose-of-flight information depends on the ability of aircraft owners, who may be one or more steps removed from the actual flying of the aircraft, to obtain detailed information about the aircraft's flying activities during the previous year.

10. Accurate public and civil aircraft flight hour estimates depend on the currency and accuracy of the FAA Civil Aviation Registry. However, it can be conservatively estimated that about 19 percent of registry records are outdated or incorrect, impeding flight activity sampling and estimation processes.

11. Too few public aircraft are sampled as part of the General Aviation and Air Taxi Activity Survey; as a result, sampling error is much higher for estimates of public aircraft flight hours than for estimates of general aviation flying conducted for personal or business reasons.

12. The General Aviation and Air Taxi Activity Survey questionnaire is designed in a way that prevents the reporting or estimation of public aircraft flight hours according to purpose of flight.

13. Civil Air Patrol flight hours made up about 7 percent of the FAA's 1999 overall estimate of public use flight hours despite the fact that CAP flights are not considered public aircraft operations under current statutes, inflating the FAA's annual estimate of public use flight activity.

14. The Federal Aviation Interactive Reporting System, currently being deployed by the General Services Administration (GSA), should enhance the GSA's ability to monitor Federal government aircraft activity and should allow the GSA to provide better information to other Federal agencies, including the Safety Board.

15. The development of separate, independent activity data collection systems by the Federal Aviation Administration and the General Services Administration is leading to the collection of flight hour data in terms of incompatible categories of purpose of flight. This will make it difficult, if not impossible to compare accident rates for Federal public aircraft versus other public aircraft for specific kinds of flying activities.

Recommendations

As a result of this safety study, the National Transportation Safety Board makes the following safety recommendations:

To the Federal Aviation Administration:

Revise the General Aviation and Air Taxi Activity Survey data collection system to more clearly distinguish between government aircraft operations that qualify for statutory public aircraft status and those that do not. (A-01-73)

Identify and implement methods independent of the General Aviation and Air Taxi Activity Survey that can be used to check the accuracy of nonairline flight hour estimates. (A-01-74)

Implement a program that will (a) measure and track the currency of aircraft owner contact information in the Civil Aircraft Registry and (b) systematically improve the currency of this information in a measurable way. (A-01-75)

Revise the sampling strategy of the General Aviation and Air Taxi Activity Survey to achieve a precision of public use flight hour estimates (in terms of sampling error) that is equivalent to the precision of estimates for personal, business, or corporate subcategories of general aviation. (A-01-76)

Develop a new reporting matrix on the General Aviation and Air Taxi Activity Survey form that separates the administrative purpose of flight (for example, personal, business, corporate, regional, air taxi, air tours, sightseeing, public use, air medical services, search and rescue, and so on) from the actual flying activity performed (for example, transport of passengers, flight instruction, aerial observation, aerial application, external load, and so on). Incorporate these changes in published flight hour estimates. (A-01-77)

Revise the General Aviation and Air Taxi Activity Survey form so that aircraft owners can report public aircraft flight hours according to the level of government served (Federal, State, or local) within each purpose-of-flight category. (A-01-78)

Remove Civil Air Patrol flight hours from future estimates of public aircraft activity so that the figures are consistent with the current statutory definition of public aircraft. (A-01-79)

In cooperation with the General Services Administration, define purpose-of-flight categories in the Federal Aviation Interactive Reporting System that correspond to purpose-of-flight categories in the General Aviation and Air Taxi Activity Survey. (A-01-80)

To the U.S. General Services Administration:

Collect and maintain aircraft flight hour data from Federal agencies in such a way that it is possible to distinguish Federal public aircraft flight operations from other Federal government-sponsored flight operations. (A-01-81)

In cooperation with the Federal Aviation Administration, define purpose-of-flight categories in the Federal Aviation Interactive Reporting System that correspond to purpose-of-flight categories in the General Aviation and Air Taxi Activity Survey. (A-01-82)

By the National Transportation Safety Board

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Adopted: October 23, 2001

Appendix A

Partial List of Federal Aviation Safety Regulations That Do Not Apply to Public Aircraft

14 CFR	Description
43	Maintenance, preventive maintenance, rebuilding, and alteration
61.5	FAA pilot and medical certification requirements
91.7	Aircraft airworthiness requirement standards
91.8	Aircraft flight manual, marking, and placard requirements
91.15	Dropping of objects requirements
91.17	Prohibition of operation of aircraft by crewmembers who might have used alcohol or drugs within certain time frames and circumstances
91.103	Certain preflight actions
91.105	Requirement of flight crewmembers to be at duty stations
91.107	Use of safety belts, shoulder harnesses, etc.
91.167	Fuel requirements for IFR flight
91.203	Requirements for airworthiness and registration certificates and presence on board aircraft
91.207	Emergency locator transmitters
91.311	Towing of things by aircraft
91.401	Aircraft maintenance requirements

Appendix B

Statutory Definition of "Public Aircraft"

Title 49 United States Code, Section 40102(a)(37) (as amended by Public Law 106-181):

"public aircraft" means any of the following:

(A) Except with respect to an aircraft described in subparagraph (E), an aircraft used only for the United States Government, except as provided in section 40125(b).

(B) An aircraft owned by the Government and operated by any person for purposes related to crew training, equipment development, or demonstration, except as provided in section 40125(b).

(C) An aircraft owned and operated by the government of a State, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments, except as provided in section 40125(b).

(D) An aircraft exclusively leased for at least 90 continuous days by the government of a State, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments, except as provided in section 40125(b).

(E) An aircraft owned or operated by the armed forces or chartered to provide transportation to the armed forces under the conditions specified by section 40125(c).

Title 49 United States Code, Section 40125:

§40125. Qualifications for public aircraft status

(a) Definitions. In this section, the following definitions apply:

> (1) Commercial purposes. The term "commercial purposes" means the transportation of persons or property for compensation or hire, but does not include the operation of an aircraft by the armed forces for reimbursement when that reimbursement is required by any Federal statute, regulation, or directive, in effect on November 1, 1999, or by one government on behalf of another government under a cost reimbursement agreement if the government on whose behalf the operation is conducted certifies to the Administrator of the Federal Aviation Administration that the operation is necessary to respond to a significant and imminent threat to life or property (including natural resources) and that no service by a private operator is reasonably available to meet the threat.

(2) Governmental function. The term "governmental function" means an activity undertaken by a government, such as national defense, intelligence missions, firefighting, search and rescue, law enforcement (including transport of prisoners, detainees, and illegal aliens), aeronautical research, or biological or geological resource management.

(3) Qualified non-crewmember. The term "qualified non-crewmember" means an individual, other than a member of the crew, aboard an aircraft--

(A) operated by the armed forces or an intelligence agency of the United States Government; or

(B) whose presence is required to perform, or is associated with the performance of, a governmental function.

(4) Armed forces. The term "armed forces" has the meaning given such term by section 101 of title 10.

(b) Aircraft owned by governments. An aircraft described in subparagraph (A), (B), (C), or (D) of section 40102(a)(37) does not qualify as a public aircraft under such section when the aircraft is used for commercial purposes or to carry an individual other than a crewmember or a qualified non-crewmember.

(c) Aircraft owned or operated by the Armed Forces.

(1) In general. Subject to paragraph (2), an aircraft described in section 40102(a)(37)(E) qualifies as a public aircraft if--

(A) the aircraft is operated in accordance with title 10;

(B) the aircraft is operated in the performance of a governmental function under title 14, 31, 32, or 50 and the aircraft is not used for commercial purposes; or

(C) the aircraft is chartered to provide transportation to the armed forces and the Secretary of Defense (or the Secretary of the department in which the Coast Guard is operating) designates the operation of the aircraft as being required in the national interest.

(2) Limitation. An aircraft that meets the criteria set forth in paragraph (1) and that is owned or operated by the National Guard of a State, the District of Columbia, or any territory or possession of the United States, qualifies as a public aircraft only to the extent that it is operated under the direct control of the Department of Defense.

Appendix C

Effect On the Public Aircraft Accident Rate Of Including Civil Air Patrol Accidents

The Safety Board's public aircraft accident set included 24 Civil Air Patrol (CAP) accidents. Staff chose to include these accidents in the sample despite the fact that CAP aircraft are owned by a private corporation and CAP flights are not considered public aircraft operations under current law. This decision was made after staff learned that a large number of CAP flight hours are included in the FAA's public use flight hour estimates.

The CAP returned 14 surveys to the FAA for the 1999 General Aviation and Air Taxi Activity Survey. On these surveys, CAP personnel classified a total of 1,263 aircraft flight hours as public use. Based on the FAA's sample weighting factors for these aircraft, these surveys contributed 75,324 flight hours (7 percent) to the FAA's overall 1999 estimate of public use flight hours. The number of CAP hours included in earlier estimates could not be calculated. In order to avoid a bias that would result from excluding CAP aircraft from the accident sample but leaving CAP flight hours in the activity estimate, staff decided to leave CAP accidents in the 1993–2000 public aircraft accident sample.

Including CAP data probably had a negligible effect on the overall public aircraft accident rate. Thirteen CAP accidents were reported to the Safety Board between 1996 and 1999, an average of around 3 per year. A CAP accident rate can be estimated under the assumption that annual CAP flight activity was stable during the period 1996–1999 and that a consistent proportion of this flight activity was designated public use by CAP personnel who returned GA surveys. Based on these assumptions, staff calculated an annual CAP accident rate of 4.31 per 100,000 flight hours, which is only slightly higher than the overall public aircraft accident rate (3.66). Furthermore, CAP data contributed a very small proportion of the accidents (7.6 percent) and flight hours (7 percent) used to calculate the overall public aircraft accident rate, meaning that this slight difference had very little influence on the overall figure. For these reasons, staff believe that the inclusion of CAP data had a negligible effect on the overall public use accident rate presented in this report.

Appendix D

Selected Portions of 14 CFR Part 47 Describing Aircraft Registration Requirements

§47.45 Change of address.

Within 30 days after any change in his permanent mailing address, the holder of a Certificate of Aircraft Registration for an aircraft shall notify the FAA Aircraft Registry of his new address. A revised Certificate of Aircraft Registration is then issued, without charge.

§47.51 Triennial aircraft registration report.

(a) Unless one of the registration activities listed in paragraph (b) of this section has occurred within the preceding 36 calendar months, the holder of each Certificate of Aircraft Registration issued under this subpart shall submit, on the form provided by the FAA Aircraft Registry and in the manner described in paragraph (c) of this section, a Triennial Aircraft Registration Report, certifying--

(1) The current identification number (registration mark) assigned to the aircraft;

(2) The name and permanent mailing address of the certificate holder;

(3) The name of the manufacturer of the aircraft and its model and serial number;

(4) Whether the certificate holder is--

(i) A citizen of the United States;

(ii) An individual citizen of a foreign country who has lawfully been admitted for permanent residence in the United States; or

(iii) A corporation (other than a corporation which is a citizen of the United States) lawfully organized and doing business under the laws of the United States or any State thereof; and

(5) Whether the aircraft is currently registered under the laws of any foreign country.

(b) The FAA Aircraft Registry will forward a Triennial Aircraft Registration Report to each holder of a Certificate of Aircraft Registration whenever 36 months has expired since the latest of the following registration activities occurred with respect to the certificate holder's aircraft:

(1) The submission of an Application for Aircraft Registration.

(2) The submission of a report or statement required by §47.9(f).

(3) The filing of a notice of change of permanent mailing address.

(4) The filing of an application for a duplicate Certificate of Aircraft Registration.

(5) The filing of an application for a change of aircraft identification number.

(6) The submission of an Aircraft Registration Eligibility, Identification, and Activity Report, Part 1, AC Form 8050-73, under former §47.44.

(7) The submission of a Triennial Aircraft Registration Report under this section.

(c) The holder of the Certificate of Aircraft Registration shall return the Triennial Aircraft Registration Report to the FAA Aircraft Registry within 60 days after issuance by the FAA Aircraft Registry. The report must be dated, legibly executed, and signed by the certificate holder in the manner prescribed by §47.13, except that any co-owner may sign for all co-owners.

(d) Refusal or failure to submit the Triennial Aircraft Registration Report with the information required by this section may be cause for suspension or revocation of the Certificate of Aircraft Registration in accordance with Part 13 of this chapter.

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